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W. James

Civil Engineer

Projector of the Liverpool & Manchester & other Railways

Born 13th June 1771 Died 28th April 1837

Engraved by W. Ridley from a Miniature by Chalon

THE

MECHANICS' MAGAZINE,

MUSEUM,

Register, Journal,

AND

GAZETTE,

APRIL 6th,—SEPTEMBER 28th, 1839.

VOL. XXXI.

"Science is progressing; human enjoyment moves with it, and is determined by it. It is delightful to track it, even though we cannot perceive how we are immediately concerned therewith."

CENTRAL SOCIETY OF EDUCATION.

LONDON:

PUBLISHED FOR THE PROPRIETOR BY W. A. ROBERTSON,

MECHANICS' MAGAZINE OFFICE, FLEET-STREET.

1839.

NEW YORK
PUBLIC
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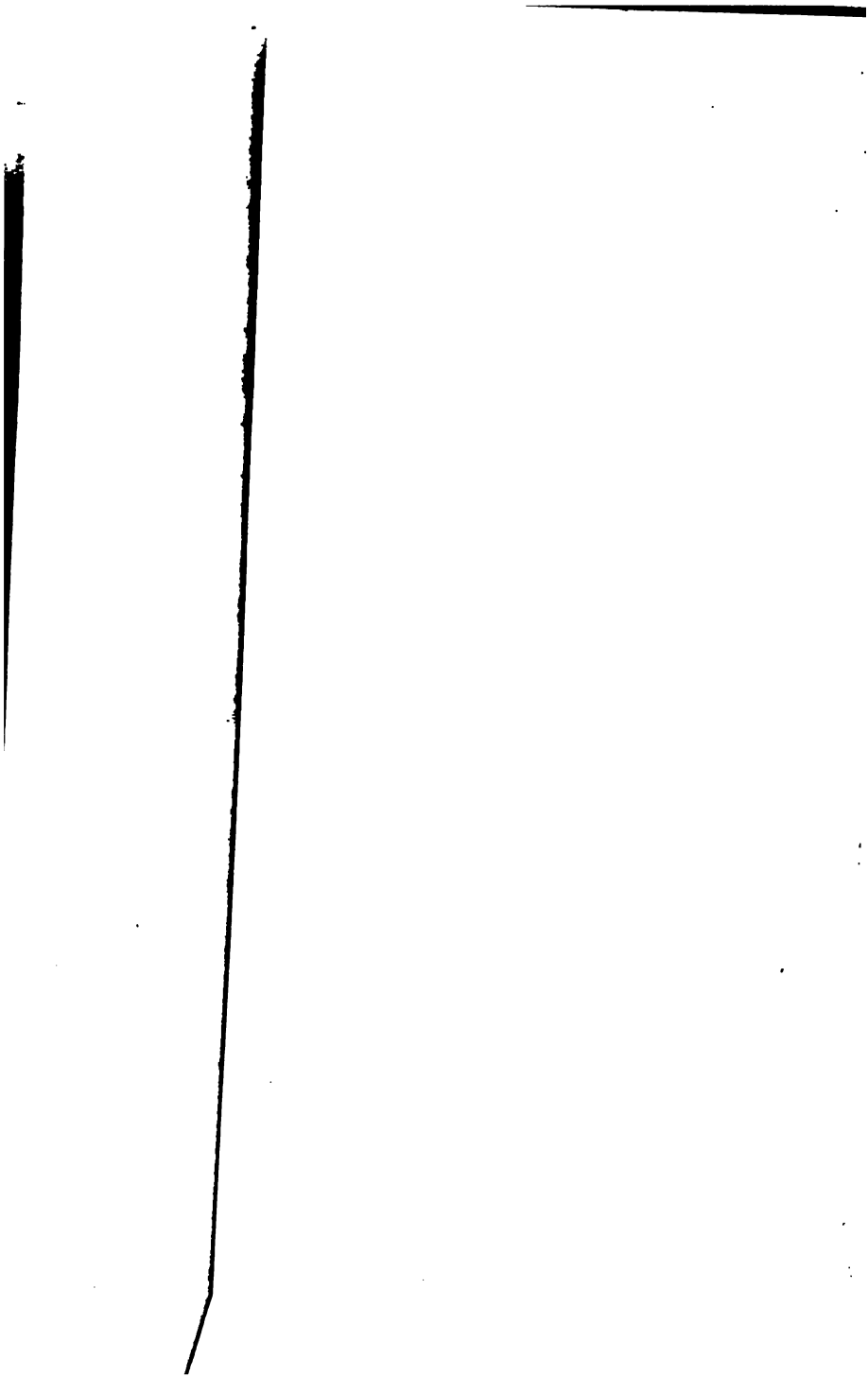
PRINTED BY W. A. ROBERTSON, 106, FLEET STREET.



Mechanics' Magazine,

JSEUM, REGISTER, JOURNAL, AND GAZETTE.

817.] SATURDAY, APRIL 6, 1839. [Price 3d.

Printed and Published for the Proprietor, by W. A. Robertson, No. 6, Peterborough-court, Fleet-street.

HEARN AND DAVIES'S PATENT STEAM BOILER.

Fig. 1.

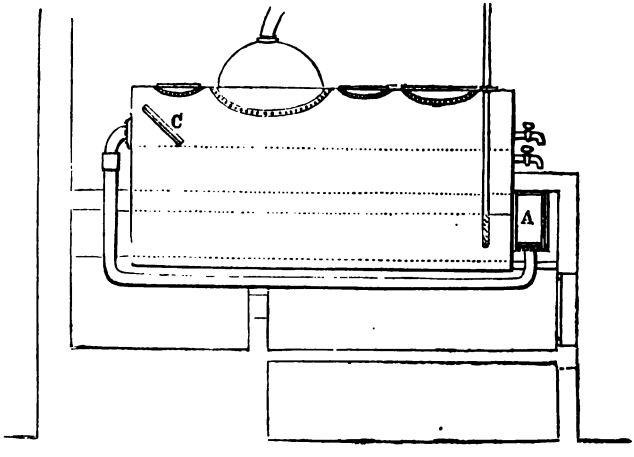


Fig. 3.

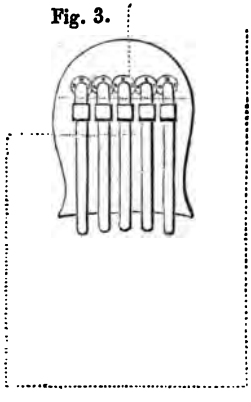


Fig. 2.

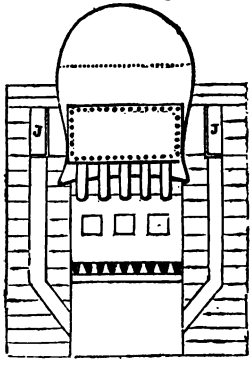


Fig. 4.

HEARN AND DAVIES'S IMPROVED BOILERS FOR THE GENERATION OF STEAM AND HEATING OF WATER.

Sir,—Before describing the figures annexed, it will be useful to enumerate the several advantages stated by the patentees to be derivable by the adoption of these improvements.

1st. That the great inconvenience and loss of time at present existing in "getting up" of the steam in large manufactories, steam-boats, &c. will be prevented, as in five minutes after the fire is properly lighted, steam begins to generate.

2nd, From the decreased consumption of fuel, less stowage room will be required in steam-boats.

3rd, From the rapid generation of steam, a very high power may be kept up for a long time, without the use of much extra fuel.

4th, That in boilers which are now in general use, when the patent tubes are applied, there will be saved one-third of the time in consequence of the quicker generation of steam, and also one-third of the boiler-room or more, and therefore a less quantity of water will be required, and also fuel, and at the same time the steam be rendered purer.

5th, This invention will prevent boilers from exploding by reason of the water being constantly in quick circulation, so that the sides of the boiler can never become overheated, nor charged with gases, which is frequently the case when the iron becomes red-hot, and which causes the explosion.

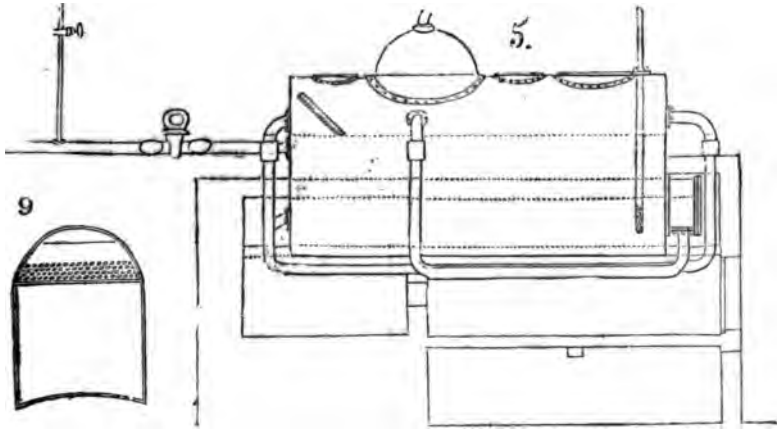
6th, It will be at once perceived from reference to the engravings, that this apparatus may be attached to all kinds of boilers; and that there will be no difficulty in making good any damage that may by any possibility occur, on sea or land.

7th, That the fire will be found to burn more freely by means of the draft caused by the pipes being placed at some distance below the boiler, and in the flue, and at the same time no inconvenience will arise to the engineman, either in stoking or supplying the fuel.

8th, This apparatus is applicable for boiling sugar, oil, soap, and other fluids. Many practical men are of opinion that *pipes when placed in contact with the fire will burn out or consume; this is true if they are not regularly supplied with water or other fluids*, but in this improvement they are so arranged, that it is impossible but that they must be regularly supplied with water, unless the boiler be allowed to become dry, which, of course, can never be the case, except from the grossest neglect on the part of the engineman. We have had (say the patentees) almost daily experience for many years, and are well acquainted with the action of fire on the surface of pipes when filled with fluid passing through them, and have seen tubes after they have been in daily operation for three years under a very great pressure and heat, and yet they are this moment as sound as if they had never been used.

9th, In the case of heating water for buildings, soap, oils, sugar, &c., the boiler will be required to be kept full, or above the tubes, so that the circulation may be kept steadily in action.

Description of the Engravings.—Figure 1, side view of boiler. Figure 2, front view of boiler. Figure 3, end view of waggon tilt steam-boiler having the improved apparatus attached to it. (These figures are on the front page). A is a metal box, rivetted to the front of the boiler and opening into it; B B are metal pipes or tubes with flanges at their ends, secured to the box by screws, rivets, or otherwise. These pipes or tubes descend from below the level of the water in the boiler, and pass underneath it through the fire, and ascend and enter the back end of the boiler above the level of the water contained within it, where they are likewise secured by screw or rivets. By this means a rapid circulation of the water is produced as it is heated in passing through the fire, it entering at the lower end of the pipes, and passing off heated into the boiler at their upper ends, and at the same time giving off steam generated thereby. C, in fig. 1, is a metal plate pierced with holes which is secured at both ends to the boiler, and is placed in a diagonal direction opposite to the upper ends of the pipes or tubes B B; its use is to cause the water which comes over with the steam to be separated from it, and to be thrown downwards into the water again, whence the steam thereby is rendered pure. Fig. 4, shows the bottom of the boiler, and the pipes or tubes B B, passing beneath it.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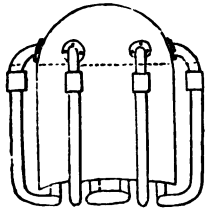
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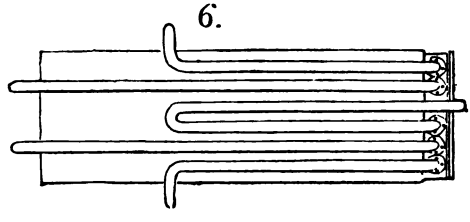
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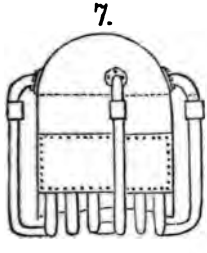
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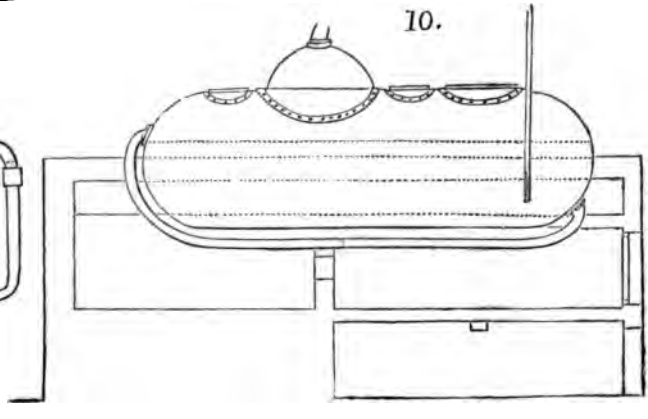
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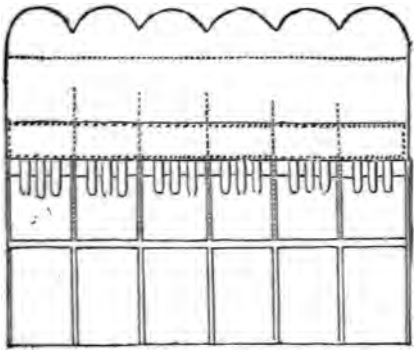

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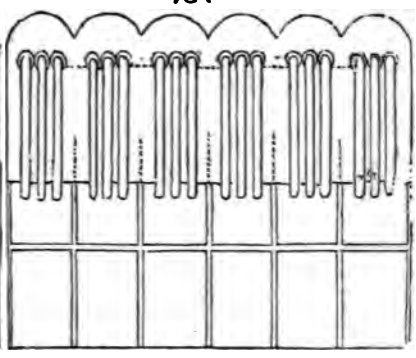

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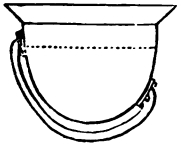

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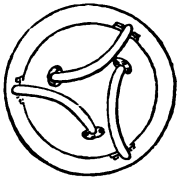

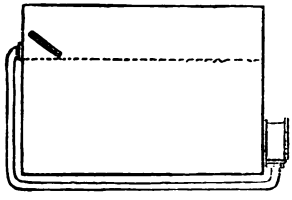

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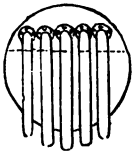

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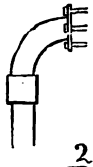

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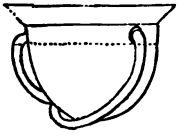

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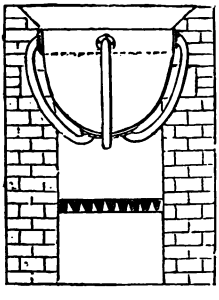

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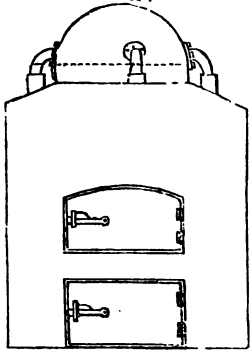


Fig. 5, Is a side view of another waggon-tilt steam-boiler, showing another arrangement of pipes or tubes. The two external ones proceed as above described from the box A, and as shown in the under view, fig. 6, and pass underneath the bottom of the boiler; but instead of passing to the opposite end, they are turned sideways, and pass into the boiler at its sides above the level of the water within it. The two pipes or tubes next to them likewise proceed from the box A, but enter the back end of the boiler above the level of the water, in the manner first described; the middle pipe proceeds from the box A, a certain distance underneath the bottom of the boiler, and then returns and enters the boiler at its front end above the level of the water. Fig. 7, is a front view of boiler fig. 5. Fig. 8, back view of the same. Fig. 9, transverse section through the boiler, showing the metal diagonal plate C perforated with holes.

Fig. 10, Side view of cylindrical boiler with hemispheric ends with the apparatus attached. Fig. 11, back end view of boiler fig. 10.

Fig. 12, Elevation of the front of a marine boiler, composed of six boilers arranged side by side. Fig. 13, back view of the same. Fig. 14, side view of the same.

Fig. 15, The upper part of one of the pipes or tubes B B, on a larger scale, and being formed with copper lined inside or any other metal less liable to corrosion then iron and copper alone, and fitted by means of screws, or otherwise to the other part of the pipe.

Fig. 16, Upright metal pipe to be screwed on to the top of the boiler, a valve opening upwards from a short pipe in the tube, and also a pipe for the purpose of conveying steam to vapour baths and other vessels.

Fig. 17, Represents an open boiler having a pipe or tube proceeding from its lower part, and passing underneath the boiler through to the fire and entering at its upper part.

Fig. 18, Similar boiler furnished with four similar tubes.

Fig. 19, Another boiler with 3 pipes or tubes, which, instead of passing perpendicularly, as in fig. 17 and 18, are curved and pass obliquely upwards, entering the *boiler at tangents, whereby they will give a circular movement* or stirring action to the substance to be boiled as in the case of soap boiling, palm oil, or other oils.

Fig. 20, Is a view of the under side of the same boiler.

Fig. 21, Is the front end of the boiler fig. 5, and section of brickwork. As the rapid action or circulation produced in the arrangements must necessarily carry off much of the heat from the furnace, therefore it will be desirable to supply it with hot air, this may be effected by dividing the brick flues passing along the sides of the boilers in the middle by means of metal plates, as is seen in fig. 2, at J J.

I am, Sir,

Your obedient servant,

ED. WHITELEY.

Langham Place, Feb. 1839.

ON THE MACHINERY EMPLOYED IN THE MANUFACTURE OF ILLUMINATING GAS.

Sir,—Having done me the honour to give publicity (in No. 811 of your journal) to a description of my hydraulic gasometer counter-balance, I am induced to address you upon the subject of the manufacture of coal gas.

It will scarcely be credited by individuals not immediately engaged in the actual production of this article, that there is no other branch of our domestic trade conducted upon less economical principles; and it is a fact that merits investigation on the part of gas-proprietors, that an immense annual sum of money is annually sacrificed by many of our large establishments in consequence of the enormous waste of gas, and destruction to the apparatus, which continually result from the defective modes now generally practised in the generating and storeing processes.

We frequently hear of the great improvements that have been made upon the machinery of the early gas manufacturers; but it will be found upon impartial inquiry, that those improvements have not effected any material diminution in the cost attending the production of illuminating gases; they have merely gone to the extent of rendering the primitive machinery more picturesque in appearance, and perhaps in some few instances, more scientific in construction.

That we derive no pecuniary benefit from those improvements may be ascertained from the knowledge (which is every day becoming more extended (that the present manufacturers do *not* produce the article at less cost than the early speculators in the trade; indeed I am convinced, upon the testimony of the most skilful men employed in the works of the metropolis, that gas was produced at considerably less expense 15 or 20 years ago than it is now.

If this be the case, the question will arise—What is the intrinsic value of that progress which an experience of nearly a quarter of a century has enabled us to make? With respect to pecuniary advantages, gas companies assuredly have accomplished nothing; on the contrary, the immense expenditure of capital involved in the introduction of *merely* a more elegant description of machinery has tended to lessen the profits which might have been derived from the manufacture, were it conducted upon principles that are more in accordance with our present knowledge of chemistry.

We find (notwithstanding the flattering but unfair eulogiums passed by interested parties upon modern improvements in this art) that in 1820 as great, if not a greater, quantity of carburetted hydrogen was evolved from a given quantity of coal, than in 1839. The quantity of fuel consumed in the retort furnaces, also, is not less at the present time than at that period; and in the article of lime required for purification, the quantity consumed immeasurably exceeds that which was used by the early manufacturers.

It is evident, therefore, that the improvements alluded to are little better than imaginary, certainly neither permanent nor substantial advantages have resulted from them: the inventors, it is true, have in many cases realised fortunes, while the proprietors of gas establishments have not received any satisfactory return for the capital they have advanced, in order to bring into operation the fanciful contrivances of ingenious speculators.

During the last 25 years the machinery employed in all other branches of manufacture has been improved to a vast *extent; and the capitalists engaged* therein *have derived advantages commensurate* with the introduction of what may in reality be termed substantial inventions. But, unfortunately for the prosperity of gas proprietors, there exists a species of interdict to the admission of real improvements; particularly when such improvements emanate from the minds of honest artisans, whose excellent practical suggestions would (were they to obtain publicity) tend to expose the destructive effects to gas property, which the machinery of modern theorists is now producing.

If a similar system of exclusion were tolerated in other departments of manufacture, the public would not derive the same amount of enjoyment from the purchase of superior and cheap commodities as they do at present; neither would capitalists obtain a fair return for the vast sums of money annually embarked in the production of marketable articles; and it is to be regretted that gas proprietors are extensive sufferers from the prejudice and ignorance hourly manifested by persons who are entrusted with the conducting of the manufacturing process of an article, which, under more favourable auspices, might be rendered a most lucrative trade.

But this manufacture cannot arrive at that state of perfection to which it must ultimately attain, until proprietors are as thoroughly initiated in the peculiarities or mysteries of the various processes as the most skilful of their operative servants. Then, indeed, will their property become a source of profitable revenue; as the insight which a determined study of the subject must secure them, will, they may be assured, enable them to detect (without relying upon the representations of others) much that has been extremely detrimental to their interests.

I shall now, Sir, with your permission, proceed to the practical part of my subject, by laying before the numerous readers of the *Mechanics' Magazine* who are interested in the welfare of this trade, a detail of the losses to which gas property is exposed, in consequence of the defective operation of certain portions of the apparatus.

In the description of the Hydraulic Counter-balance it will be observed that I have attributed the damage to gas works, and waste of gas, chiefly to the injudicious practice of conveying the gas into heavy reservoirs. It would appear

that manufacturers are not conscious of this important defect, otherwise we should not witness in several of the Metropolitan establishments the crowns of their gasometers loaded with several tons' weight of metal, during the process of charging them. This accumulated weight is required to give an increased impetus to the current in the street mains; but it must be apparent that the same gasometer thus loaded, will, during the time occupied in charging it, cause a continuous recoil upon the whole of the internal machinery; for the progress of the fluid in its passage from the retorts, must be materially retarded by this opposing force; and it is only the superior momentum communicated to the gas by the intense temperature of a proportionate number of generating vessels, that enables it to overcome this extra weight of metal.

In a clear sun-shiny day, the effects of the "back pressure" thus created, will be conspicuous in the retort house, as nearly the whole of the internal space of this building is occupied by a (more or less bulky) volume of a pale violet tinted vapour. The experienced eye of the intelligent foreman of this department of the works, will readily observe that this vapour is a considerable portion of the carburetted hydrogen, which the *heavy gasometer* is causing to issue from the fractures and interstices that are produced, by the same cause, in the retorts, the ascension pipes, and hydraulic main. I have frequently remarked the honest regret depicted upon the countenances of some of our experienced stokers, when viewing this irredeemable waste of their unconscious employers' property. But this is merely one instance of the destructive effects resulting from "back pressure." I am aware that there are many individuals engaged in the manufacture who believe this vapour to be the steam generated from the moist luteing of the retort-lids; and while this fallacious opinion is entertained by proprietors, the waste of gas produced in this way will be perpetuated.

We shall now endeavour to estimate the quantity of gas destroyed during the process of drawing the charges from the retorts.

During the winter season, which may be estimated at five months, several of the large works employ from 300 to 400 retorts; and for the remaining seven months this number is reduced to about 200. The average number of retorts in action during the whole year will be found to be about 250.

By calculation it will be seen that the unoccupied space in each retort (that is, the space immediately over the coals) when added to the cubical area of the internal space of the ascension pipes, and the contents multiplied by the number of "draws" that take place in twenty-four hours—that a waste of gas to the amount of at least 8*l.* per week is incurred.

But these are not the only evil effects that result from using weighty reservoirs; for the products extracted from the coal being confined for too long a period in the generating vessels, a greater accumulation of sulphuretted ingredients mixed with oxydized iron, will attach to the interior surfaces of the retorts; hence the troublesome and destructive process of "Scurfing" will more frequently be required.

The gas manufacture is often inconvenienced by the stoppages that take place in different parts of the pipes leading from the retort-house to the reservoirs; these interruptions are caused by accumulated deposits, formed of ammoniacal salts, oxide of iron, and liquified pyrites; the passages of the inlet and outlet pipes are frequently impeded by these deposits; and the orifices of the pipes being thus to a certain extent choked up, forms an additional impediment to the free transmission of the gas from the retorts to the gas-holders. Effects of this nature may be in a great measure avoided by working gas-holders of light weight; as, for example, suppose that a gas-holder is equal in weight to 12 tons, this weight may be reduced to half that amount by attaching to the counter-balance-chains light tanks, capable of containing six tons weight of liquid, and when the gas-holder is charged to its full complement, the liquid, by means of self-acting valves, may be discharged; thus the weight which was deducted is again recovered, without resorting to the dangerous and inconvenient method practised of removing and replacing the solid weights which are at present in use in several of our factories.

By working gas-holders with tanks

containing liquid, a powerful *draught* or direct current is created from the retorts, which must greatly facilitate the generating process, and consequently economise the whole of the operations of the machinery employed in the retort-house, the condensing and purifying chambers. Indeed I think I may venture to say that a vast amount of benefit may be derived by gas companies from the introduction of this simple (and certainly not expensive) apparatus.

I am, Sir,

Yours, most respectfully,

DAVID MACRAE, Engineer.

Vauxhall, March 26, 1839.

QUESTION IN TRIANGULATION.

Sir,—I have observed some elegant solutions on the subject of triangulation given in your interesting Magazine. The following question I consider one of the most important I have ever seen proposed in that highly useful application of mathematical science, which I trust some of your able mathematical contributors will give a solution for.

I am, Sir, your obedient servant,

WM. JONES.

Oxford, March 12, 1839.

Question.—In the valley of Chamonni, three positions A, B, C, were selected in a straight line, such that A B = 80, B C = 75 yards: Three remarkable points A′, B′, C′, on the side of Jura, were chosen to be observed; the angles of elevation A′, as seen from A, B, C; were 67°. . 10′, 68°. . 15′, and 52°. . 18′ and those of B′ as seen from the same points were 72°. . 18′, 78°. . 15′, and 70°. . 10′, and finally, those of C′ were 60° . . 5, 61°. . 10′, and 58°. . 5′ respectively. It is required from these observations to find the distances of A′, B′, C′, from one another, and from A, B, C, together, with their altitudes above Chamonni, and the inclination of the plane passing through the three points A′, B′, C′ to the horizon of the place in question.

W. J.

REPORT OF THE COMMITTEE OF THE FRANKLIN INSTITUTE ON THE EXPLOSIONS OF STEAM-BOILERS.—PART II.—REPORT OF THE SUB-COMMITTEE ON THE STRENGTH OF MATERIALS EMPLOYED IN THE CONSTRUCTION OF STEAM-BOILERS.

[From the *Franklin Journal*.]

(Continued from vol. xxx, Page 477, No. 816.)

As some of the experiments which furnished the standards of comparison for strength at ordinary temperatures, were made at 80°, and as at that point small variations in respect to heat appear to affect but very slightly the tenacity of iron, it was conceived that for practical purposes at least, the calculations might be commenced from that point.

Eighty degrees are therefore deducted from each temperature in the following table, and the remainders used, instead of the numbers commencing from the 0 of our scale. It will be found that with the exception of a slight anomaly between 520° and 570°, amounting to —.08, the numbers expressing the ratio between the elevations of temperature, and the diminutions of tenacity, constantly increase until we reach 932°, at which it is 2.97, and that from this point the ratio of diminution decreases to the limits of our range of trials, 1317°, where it is 2.14. It will also be observed, that the diminution of tenacity at 932°, where the law changes from an increasing to a decreasing rate of diminution, is almost precisely one-third of the total, or *maximum* strength, of the iron at ordinary temperatures.

At this point it will be seen, the curve traced in the figure, Plate X., undergoes an inflection, and in all probability continues in the same general direction to the fusing point.

TABLE XCI.

No. of the comparison.	Observed temperatures.	Observed temperatures—90°.	Observed diminution of tenacity.	Power of the temperature which represents the diminution of tenacity at each point.	REMARKS.
1	520°	440°	.0738	2.25	
2	570	490	.0869	2.17	
3	596	516	.0899	2.38	
4	662	582	.1155	2.67	
5	770	690	.1627	2.85	
6	824	744	.2010	2.94	
7	932	852	.3324	2.97	Point of inflection near this temperature.
8	1030	950	.4478	2.92	
9	1111	1031	.5514	2.63	
10	1155	1075	.6000	2.60	
11	1237	1157	.6622	2.41	
12	1317	1237	.7001	2.14	
			Mean	2.58	

From the above table it appears that the ratio of diminution furnished by a comparison of some of the lower temperatures with all those above them, is higher than the duplicate. The same inference is derived from a comparison of the higher members of the series with all those below them.

At 932° it will be seen that a comparison with all those both above and below that temperature, gives a rate very nearly approaching to the cube. The particular comparison between 824° and 932° gives a rate higher than the 4th power, viz. 4.08.

Hence, though the diversity of the metals operated on, is such as not readily to furnish the precise mathematical law, it is still abundantly apparent that this law must be different from that which is indicated by any one of the family of parabolas.*

But for practical purposes the table indicates, by the *mean* of all the rates, that a rule may be followed, not widely different from what is represented by saying that the *thirteenth power of the temperature above* 80° *is proportionate to the* 5*th power of the diminution from the maximum tenacity.*†

Plate X. exhibits at .1517, in the line of observed diminution, the commencement of a branch of the curve descending to the right, which indicates the progressive effects of temperature, increasing, as it rises, the tenacity of iron, until a certain point is reached, when the weakening influence begins to be felt. The other branch of the curve, or that which takes its rise from the origin of the abscissas, forms, with the first, a cusp of peculiar character at a point *c*, which, however, the experiments are not sufficiently numerous in this part of the scale, to determine exactly in respect to *position*.

Elasticity of Iron.—In describing the method of determining the elasticity of the *machine* for tenacities, we have given in effect a detail of the processes also pursued with the bars of iron generally.

The strong bar then interposed between the heads, *b' b''*, (Plate 1.) was, however, now replaced by the specimen under trial,

* Represented by the well known general formula, $y^{q} = mx^{p}$.

† It is evident from what has already been said, that if we would *calculate* the reduction from the ordinary strength of iron as it comes from the hammer or the rolls, we must first reduce it to the maximum, by adding *to its observed strength at a known low temperature, 15.17 per cent. of itself.* It is, *moreover, apparent from the curve, as well as from* the table, that if we conceive the ordinates (y) or increments of temperature, and the abscissas (x) or decrements of tenacity to be drawn from any two points *below* 932°, the increase (dx) of any abscissa, for the contemporaneous increase (dy) of the corresponding ordinate, will observe an *increasing rate;* but *above* that point where also the *differential co-efficient* $\frac{dy}{dx}$, is a maximum, and where the *differential co-efficient of the second order* $\frac{d^2y}{dx^2} = 0$, they observe a decreasing rate, and the concavity of the curve is accordingly directed towards the axis of the abscissas, in place of the convexity which had hitherto inclined in that direction.

and as the machine was capable of overcoming the total strength of each specimen, the temporary elongations, as well before as after the bar had begun to be permanently extended, were easily deducible from the observed elasticity of the *bar and of the machine together*, corrected by deducing the already ascertained elasticity of the machine alone.

By referring to a former part of this report (Table III.) there will be found a series of numbers, corresponding to the several observed elasticities of the machine, used by the committee, and representing in inches the actual distances, or quantities of recoil after the strain had been removed. From those numbers may be taken out *by inspection*, the quantity of recoil for each trial in the following table, and comparing the results thus obtained with the total lengths of the bars, it will be seen by what part of its whole length, each was elongated and contracted at every trial.

It will not fail to be remarked that in the more extended series of the table, those, for example, in which 7 or 8 trials were made on the same bar, the maximum of elasticity was often found within a comparatively small number of pounds of the *breaking weight*, and that it was seldom so low as two-thirds of that weight. This is at variance with the supposition that the elasticity of a bar is destroyed or much diminished at the moment it has begun to be permanently elongated.

Second method of observing elasticities.—Another method of approximately determining the elasticity of iron as indicated when subjected to different strains, was to measure directly on the specimen under trial the distance between two points, taken as remote from each other as possible, both when under strain and when that strain was removed.

Thus bar No. 49 having been permanently elongated $\frac{3}{10}$ of an inch, in $20\frac{3}{10}$, under a weight of 273 pounds in the scale, gave a recoil of .05 of an inch. Afterwards, with a weight of 301 lbs., and when a permanent elongation of .58 inch, in the same original length, had taken place, the recoil amounted to $\frac{1}{8\,4\,8}$ of the total length. After that trial 15 pounds in addition were required to break the bar.

On bar 226 the first permanent elongation was found under a weight of 245 pounds. Under a weight of 280 pounds the elongation in 24 inches was .86 inch, and when relieved it was .82, giving a recoil of .04 in 24 inches, $=\frac{1}{6\,0\,0}$. After this last trial 35 pounds additional weight were required to produce the fracture.

On bar 228 we find that the first elongation was taken under a weight of 232 pounds. With 238 pounds it had become .146 inch on a length of 24; but when relieved the recoil was .046 inch, equal to $\frac{1}{5\,2\,3}$ of the length. Twenty-eight pounds were afterwards required to be added to break the bar.

On bar 230 the elongation took place under 196 pounds. With 317 pounds the recoil on a part originally 24 inches long was .05 inch, equal to $\frac{1}{4\,8\,0}$ of the whole original length, and 13 pounds more were required to produce the fracture.

Experiments and remarks on this subject will be found in tables XXXVII., XL., LV., LIX., &c.

Diminution of area at the moment of fracture.—With a view to determine within certain limits the extensibility of iron when subjected to strain, and to compare the same in specimens cut across the sheet with that of longitudinal strips, a considerable number of measurements were taken at the sections of fracture after the experiment, and from these the above table of results is exhibited, indicating the mean result of the trials on each bar and the ratio of the remaining area to the original area taken as unity.

In taking these measurements some little uncertainty is to be admitted, owing to the fracture taking occasionally a diagonal direction, but as the two fragments afforded the means of obtaining corrections, the error from this cause cannot have, at most, exceeded a few thousandths of an inch.

By referring to the table of permanent elongations as taken on the whole bar, (Table XCIV., *Frank. Jour.*, vol. xx, p. 92) it will be seen that the greatest extension observed on an entire bar, previous to the first fracture, was 3 inches in 24, or one-eighth of the total length. This was on a bar reduced to a uniform size. But as no bar of iron, of any considerable length, is of uniform strength throughout, we are not to expect in any case an extension in length *of the whole bar* equal to the diminution of area at the point of fracture.

One remark worthy of particular attention, in connection with our subject, is, that at elevated temperatures, before the diminution of strength has begun to be felt, the diminution of area or *constriction* of iron is often much less, than when the trial is made on the cold metal. This is particularly exemplified in bar No. 164, in which two experiments at 577°, gave a tenacity 14 per cent. greater than five others, made at from 75° to 80°, while the constriction was less in the hot trials than in the cold, in the proportion of .338 to .447, or about *one-third*. In this and similar cases the fractures at high temperatures were observed to take place suddenly, and the surfaces of fracture

to present appearances altogether different from those found in cases where the same bar was broken cold. This peculiarity consisted in a smooth section, directly across the breadth of the filed portion in which they took place, but uniformly inclined to the flat face of the bar, in an angle of about 45 degrees, and presenting, therefore, a bevel, like the cutting edge of a common mortising chisel.

In a few instances, particularly in experiments on bars as they came from the shears, the fracture was compound, the strengths at two neighbouring sections being so exactly equal as to separate simultaneously, at the distance of half an inch or an inch from each other.

Bars 228 and 230, the former of which was cut crosswise, and the latter lengthwise of the sheet, and both broken up at ordinary temperatures, indicated a marked difference in the nature of the surfaces of fracture. The former presents, in nearly all instances, irregular and jagged surfaces inclining to compound fracture, or displays rough sections perpendicular both to the edges and faces of the bar. The latter is oblique and fibrous.

The amount of constriction in strips cut across the direction of rolling is, on an average, about 6 per cent. less than in those cut longitudinally.

A careful comparison of the breadths and thicknesses before and after fracture would show that the diminution in thickness follows a more rapid rate than that in breadth, whether the iron be hammered or rolled, and whether in the latter case, it be cut lengthwise or crosswise of the sheet.

The amount of constriction observed, viz: 16¼ per cent., is rather less than that obtained by M. Martin,* who operated chiefly on rolled bars or bolts of considerable magnitude, and found on an average of 35 comparisons 18$\frac{6}{10}$ per cent. of elongation.

The above table will show that the difference in different kinds of metal in respect to the diminution of *area* of fracture is very marked, sometimes exceeding 54 per cent. of the whole original area; while at others it scarcely exceeds 5 per cent.

The difference in the extensibility of iron in the longitudinal and the transverse directions of the sheet is liable to manifest itself in practice, when a portion of a boiler becomes locally so overheated as to bulge out in a particular spot. It will then be seen that an elongated protuberance is exhibited, having the greater axis in the direction across the sheet, and the less lying in the course of the rolling.

The piece taken from an old boiler which had been burst in consequence of the gradual overheating of a portion over the fire where sediment had collected, and which will be referred to in another part of this report, exemplifies the kind of action above described. The extent of the swelling in the direction of the length of the sheet was 10½ inches, which, measuring over the summit of the bulge, had become 12½ inches; or the increase of distance over the surface of the metal was .167 of the original extent. In the transverse direction of the rolling, the original length of the swollen part was 20½ inches, and the line applied over the summit measured 23 inches, or the increase in this direction was .122 of the original length. Hence the extensions of this specimen of iron in the two directions are to each other as 167 to 122.

Some idea may be formed of the extent of constriction in *breadth*, both of iron and copper bars under various temperatures, by inspecting the figures (which will be given in our next Number) *m* and *m'* are two portions of bar No. 164, Table XLVIII., which was prepared by filing notches on its sides. The portion *m*, of which the breadth before trial was .747 inch in the deepest part of the filed section and .132 inch thick, was broken at the temperature of 576°. Strength, 66336 pounds per square inch. The breadth after fracture was .674 inch, and the thickness .102. The surface clean, smooth, and bevelled in an angle of about 45°. The diminution of area is consequently .098604—.068781=.029823 square inch. *m'* represents a portion broken in experiment 15 of the same table, at a temperature of 87.5°, giving a strength of 56503 pounds per square inch, and a section of fracture measuring .601 in breadth, and .07 in thickness;—whereas the original breadth had been .731 and thickness .138; so that the constriction was here .100878 — .042070 = .058808 square inch,—almost exactly double as much as when broken at 576°. Experiment 17 on the same bar affords another illustration of the effect of a moderately elevated temperature in preventing constriction.

The original breadth of the bar in which these notches were filed was 1.117 inch. Hence the notches in *m* were each $\frac{1.117-.747}{2}$=.185 inch deep, and those in *m'* each about .193 inch, in both cases quite sufficient to preclude the supposition of any weakening effect of the shears, within the part left after filing.

n and *n'* are portions of the bar of iron, No. 224 C, an account of which is given in Table LXXII. The breadth before trial of this bar, which was reduced to uniform size by filing, is indicated by the dotted lines out-

* *See Annales des Mines, 3d series, vol. v. 1st part.*

side of the plain ones, while the inside dotted lines mark the breadths after fracture. Both portions were broken at low temperatures. *n'* in experiment 5 of that table, at a temperature of 80°, exhibited a strength of 62472 pounds per square inch, a breadth of section=.572 inch, and a thickness of .159, consequently giving an area of section after fracture of .090948 square inch, whereas the area before trial was .182945, and the constriction .091967, a trifle more than 50 per cent. of the original section. The fracture on the portion *n* was made at the 8th experiment of the same table, when the temperature was 71°, and within one inch of the point broken in the trial just referred to. But previously to this fracture, the specimen had deen submitted without access of air to a bright welding heat, so as perfectly to anneal the iron without oxidizing it. The strength was then found to be only 36052 pounds per square inch, reckoned on the original section at that part of the bar, the breadth being .457 inch, the thickness .118, and the area .053926; while the original breadth had been .757, original thickness, .24125, and area, .182626, which had been reduced before the annealing to .150664. Hence the constriction after annealing was .182626—.053926=.128700, or 70.4 per cent. of the original cross section of the bar.

o and *o'* represent specimens of copper bar, No. 7, table XXII., to which we have already referred in speaking of the extensibility of that metal.

Forces producing permanent elongations of iron.—In connexion with the subjects of tenacity and elasticity, it has generally been deemed important to pay some attention to the relation between the forces which will break, and those which will elongate the specimens to a sensible degree, rendering them incapable of returning to their original dimensions. The committee have not been unmindful of this subject, and the following table will exhibit the most important of these observations, which have, during the course of our experiments, been made to bear directly on this point. An inspection will show that the first permanent elongation may take place under forces varying according to the character of the materials. Those kinds which possess the greatest extensibility begin in general earliest to manifest this property, in yielding *permanently* to low degrees of force. This remark is exemplified by a comparison between Nos. 226 and 219 A., the latter of which showed an extensibility before fracture of 2.5 inches in 24, or about $\frac{2}{19}$ of its whole length, and began to extend *with 41⅔ per cent. of the breaking* weight, *while the former was extended* $\frac{1}{16}$ *of* its length, or 1½ inch in 24, and required 76 per cent. of the breaking weight to cause the first elongation. The *extremes* lie between .416 and .872 of the ultimate strength; and the mean of 13 comparisons is .641, conforming nearly with the results obtained by former experimenters.

The eighth and ninth columns of the following table show the total elongation at the moment of fracture. This must necessarily be different in different bars, as well on account of the diversity in their constitution, as of the unequal degrees of *uniformity* in size and structure in different parts of the same bar.

It is not only desirable to mark the force which will produce the first permanent elongation of iron, but also to ascertain the successive elongations under different weights, since in the case of the steam-boiler it may be necessary to know what degrees of distortion in its form would result from the various forces which might be applied to it. It is true that in producing these successive elongations *time* may enter as an element into the result; but the experiments of the committee on this subject, were generally conducted with such deliberation as to preclude the supposition that a longer continuance would have materially altered the effects observed. In determining this question, recourse was had to two methods; first, that of direct measurement of the lengths after certain elongating forces had been applied, and secondly, that of gauging the cross sections at numerous equi-distant points along the bar, the results of which showed the irregularity of extension as well as its actual amount in the vicinity of each section so gauged.

Strength of Iron in different directions of the rolled sheet—In obtaining specimens for these experiments, care was generally taken to have them cut in different directions of the rolling, longitudinally and transversely, and in some cases *diagonally*, to that direction. The tables will be found to indicate the direction of slitting in each case, and the comparison contained in Tables XCV. and XCVI. (*Frank. Journ.* vol. 20, pp. 96, 97) is given to show what information the inquiry has elicited.

The comparison is made principally on the *minimum*, strength of each bar, being that which can alone be relied on in practice; for if the strength of the weakest point iu a boiler be overcome, it is obviously unimportant to know that other parts had a greater strength. In one case, however, two bars, one cut across the direction of rolling and the other longitudinally, were, after being reduced to uniform size, broken up cold, with a view to this question. The result

showed that the length-strip was 7 $\frac{1}{10}$ per cent. stronger than the one cut crosswise, considering the tenacity of the latter equal to 100. Of the other sets, embracing about 40 strips cut in each direction, it appears that some kinds of boiler iron manifest much greater inequality in the two directions than others. It is in certain cases not much over one per cent., and in others exceeds twenty, and as a mean of the whole series it may be stated to amount to six per cent. of the strength of the cross-cut bars. The number of trials on those cut diagonally is not perhaps sufficiently great to warrant a general deduction, but so far as they go, they certainly indicate that the strength in this direction is less than in either of the others.

Had we compared the mean instead of the least strength of bars as given in the table, the result would not have differed materially in regard to the relative strength in the respective directions.

For this purpose the boiler-iron manufactured by Messrs. E, H. and P. Ellicott, which was tried in all three of the directions of the sheet, and by all the three modes of preparation of specimens, will be found to give the following results,—viz. 1. When tried at *original sections*, seven experiments on length-sheet specimens gave a mean strength of 55285 lbs. per square inch, the lowest being 44399, and the highest 59307. Fourteen experiments on cross-sheet specimens gave a mean of 53896 lbs., the lowest result being 50212, the highest 58839; and six experiments on strips cut diagonally from the sheet, exhibited a strength of 53850 lbs., of which the lowest was 51134, and the highest 58773.

2. When tried by filing notches on the edges of the slips to remove all weakening effect of the shears, the *length-sheet* bars gave, at fourteen fractures, a mean strength of 63946, varying between 56346 and 78000 lbs. per square inch. The cross-sheet specimens tried after this mode of preparation, exhibited at three trials, a mean strength of 60236 lbs., varying between 55222 and 65143; and the *diagonal* strips, at four trials, gave a mean result of 53925, the greatest difference being between 51428 and 56632.

3. Of strips reduced to uniform size by filing, four comparable experiments on those cut lengthwise of the sheet, gave a mean strength of 63947, of which the highest was 67378 and the lowest 60594.

Cross-sheet specimens tried after the same preparation, exhibited, at thirty-three fractures, a mean of 50176, of which the highest was 65785, and the lowest 52778. No bar cut diagonally was reduced to uniform size.

From the foregoing statements it appears that by filing in notches and filing to uniformity, we obtained results 63946 and 63947 for the strength of strips cut lengthwise, differing from each other but a single pound to the square inch, and that by these two modes of preparation the cross-sheet specimens gave respectively 60236 and 60176, differing by only 60 lbs. to the square inch. This seems to prove that by both methods of preparing the specimens the accidental weakening effect of slitting had been removed by separating all that portion of the metal on which it had been exerted. Hence we may infer that the differences between length-sheet and cross-sheet specimens are really and truly ascribable to a difference of texture in the two directions, which will be seen to amount, in the case of filing in notches, to 6.15 per cent., and in that of filing to uniformity, to 6.26 per cent. of the strength of the cross-sheet specimens.

The single exception to the law that the greater strength is given in the longitudinal direction of the rolling, will be found explained in the remark appended to Table XCV. (*Frank. Journ.* vol. 20, p. 96.)

From the comparison of nearly eighty specimens, from ten different sorts of iron, it appears that the average minimum strength of iron in the direction in which it is rolled, is very nearly 6 per cent. greater than that in the transverse direction.

Specific gravity of Boiler-Iron.—Table XCV. contains in addition to a view of the relative tenacities of strips cut lengthwise and crosswise of the boiler plate, a column exbibiting the specific gravities of the several kinds of iron there compared. In most cases, these were obtained by cutting from the same sheet which furnished the strips, and in a contiguous part, a small sample expressly intended for a trial of its density. Several bars will consequently be found to have the same specific gravity assigned to them. But we have still no less than nineteen different experiments from which to deduce the general result. From these it appears that the highest density was 7.7922, the lowest 7.6013, and the mean 7.7344; also, that the difference .1909, between the maximum and the minimum is $\frac{1}{40 \cdot 5}$ part of the mean density, which may accordingly be taken as the limit of variations in this particular.

Seventeen different trials of specific gravity on *bar* iron give a mean of 7.7254, and the greatest difference between any two results was $7.8319 - 7.4587 = .3832$, or $\frac{1}{20 \cdot 1}$ of the mean density.

Effect of repeated Piling on the tenacity of Plate-Iron.—The effect of repetitions of the process of piling and welding, whether

of puddled iron or blooms, is exhibited in tableXCVII., (*Frank. Jour.*, vol. xx, p. 99,) in which are contained the results of trials on three specimens of iron, furnished by an establishment in Centre County, Pennsylvania, a region known to afford an ore of superior quality, and which has long supplied wrought iron, inferior to few other kinds of the article known in the American market.

Results.—1. The specimen which had been made from *refinery bloom* reduced to a bar 3 inches wide by 1 thick, piled 4 high and twice welded, proved the strongest. Not only did it exhibit the high mean result of 59247 pounds to the square inch, but the consistency and uniformity of the metal were such as to show between the highest and the lowest results a difference amounting to only 3.4 per cent. of that mean.

2. The specimen which had undergone two weldings, but had not been drawn into a bar and piled, was inferior to the preceding, giving a mean result of 58787 ; and the difference between the extremes exceeds 4.6 per cent, of that amount.

3. The specimen manufactured from puddled iron, rolled at the first operation into a bar 3½ inches wide by 1 inch thick, cut and piled 4 tier high and then twice welded and rolled into bars little more than $\frac{3}{10}$ of an inch in thickness, was obviously designed by the manufacturers to correspond in all particulars with No. 1, except that the latter was from the bloomery, and the other (No. 3.) from the puddling furnace. The mean absolute strength of this specimen was decidedly less than that of either of the preceding, being only 57613 pounds, while the variation from uniformity was 4.1 per cent. of its mean strength.

(To be continued).

ROYAL INSTITUTION—M. NIEPCE'S LIGHT-ENGRAVED PLATES—MR. COWPER'S LECTURE ON POTTERY.

March 15.—*The Conversazione.*—There were on the table casts of the footsteps of the Cheirotherium in the red sandstone of Cheshire, sent by Mr. Addams. We say, *casts*, because the impressions of the feet having been made in the soft mud subjacent the present stone, the subsequent superposition of the sand took a perfect cast of them, and consequently they are in relief. Mr. Sandiman sent a model of his railway shutters, so called, because they run on a rail into a recess, on each side of the *window case, not parallel as is usual, but perpendicular to the wall. There* was a cast of a remarkable case of the crushing in of the bones of the forehead, sent by Dr. Matthew Trueman. It must sadly interfere with phrenology, as an art, if the frontal sinuses are occasionally so capacious as to allow a depression to this extent, of the external plate of the skull; and that the depression is simply of this kind, Dr. Trueman is of opinion, from the circumstance that the man is uninjured. Mr. Newman's improved barometer was exhibited, but our limits will not allow us to describe its ingenious arrangements.

That which excited the greatest interest, was the exhibition of M. Niepce's heliographic metallic plates, to which the public attention had been drawn by a notice in the *Literary Gazette*, announcing that they exhibited the same kind of solar delineations, the discovery of which M. Daguerre had allowed to be ascribed to himself. These delineations are altogether different from those effected by the photogenic process of Mr. Talbot; they are real *etchings*, though slight in depth, on the surface of a metallic plate, *with the lights and shades in their proper positions*, whilst Mr. Talbot's are drawings on a prepared paper, with the lights and shades reversed. These plates can of course be printed from, but the impressions are, as may be expected, very faint. M. Niepce had, however, a process of further deepening the etchings, and a plate so treated was exhibited, as also a print alleged to be taken from it, but on close inspection, it was evident that it must have been printed from another plate, precisely the same in regard to the engraving, but differing a little in regard to margin and size—a circumstance which so far from throwing a doubt on the principal statement, is rather in confirmation of it. This process is stated in the *Athenæum* to be a chemical one, unknown to M. Daguerre, and to be the greatest secret of all. We are of opinion that it was effected merely by re-biting the original etching, but from the shallowness of the work, there may be greater difficulty in the operation than is usually experienced. One of the plates, being in size about 6 in. by 8 in., was a copy from a print 2½ feet in dimensions, and must have been produced by means of the camera obscura. It appears by inscriptions on the back of them, that they were among the first efforts of M. Niepce, and that they were executed at Chalon sur Saone in 1827. It is reasonable, therefore, to suppose that his later productions were more successful—that is to say, in point of depth in the first or heliographic etching, for in no other particular can we conceive it possible that M. Daguerre could

have effected his alleged improvements. Into whose possession we ask did M. Niepce's plates fall at the time of his death; or did he part with them before he died, and in whose hands were they placed? It is fortunate for his memory that specimens, however early and imperfect, have been retained by his English friends.

These plates reminded us, by the beautiful appearance they presented when the light glanced upon them in particular directions, of the similar effect produced by Mr. Saxton's lineal representations upon glass, by means of his medallion ruling machine, the precursor in point of the correction of distortion, of the machines of M. Collas and Mr. Bate. We were also, on account of a similarity of circumstances, more forcibly than ever impressed with the idea, how much more it depends on a fortunate coincidence of circumstances, than on merit and originality, whether fame and profit shall be awarded to the right individual.

The Lecture.—Mr. Cowper lectured "On Pottery." This gentleman has a peculiar and most happy talent for elucidating the manipulations and processes adopted in our manufactures, and for describing and explaining the most complicated machinery employed in them. Though on the one hand he does not overwhelm and embarrass us by entering at large into numerous details, neither on the other does he merely seize those prominent features, which are thought in general to be sufficient for a popular, but what in truth must be a very vague, apprehension of the subject; but being fully master of it himself, he takes the fitting opportunities to bring us acquainted with those minute, and sometimes very delicate points, on which hinge the success or the perfection of the ultimate results. In explaining machinery he presents to us its elements in magnified and working forms, not, however, as models of the separate parts and movements, though these are not forgotten, but as illustrations of them in respect to principle rather than to practice, and as instances of the same things in a simpler manner, and it may be in a ruder shape, but still, one much more easy of comprehension, and leading the mind gradually to a clear conception of those nicer arrangements and more refined modes of action displayed in the objects themselves. Following up this peculiar style of elucidation, by showing the adaptation of the elements of construction to those of motion, and the combination and mutual adaptation of the whole, the lecturer not only succeeds in imparting knowledge of the most exact and accurate character, but it is accompanied in the minds of his audience with the most vivid perceptions, both of the *ensemble* of the machinery and of the collocation and consentaneous working of all its parts.

In the present instance, however, Mr. Cowper's task was not a difficult one in this respect, for machinery has not introduced its iron hand very extensively into the making of pottery. It is still an art as much as it is a manufacture. The kneading of the clay is done by a pug-mill; the extrication of air from it is effected by passing it between rollers; and the extension of it through an annular aperture so as to form tubes, is produced by a powerful press. This, together with the stamping of flints into powder, and the grinding of the spherical stoppers for the patent stone jars, is nearly the utmost extent of the mechanical means employed. To show the art of pottery, Mr. Cowper introduced a potter working at his wheel, who, by his dexterity in fashioning his material into various forms, obtained great applause from the audience. The mode of obtaining relief ornaments for common ware, by pressing clay into plaster moulds, was explained and exemplified; and another method by casting them with clay in a fluid state for the better kind of ware, was adverted to. The different stages through which china passes was shown, and illustrated by specimens; and the mode of transferring prints as ornaments to its surface was described, with reference particularly to the improvement introduced of late, of using for this purpose instead of paper, the elastic sheets composed of the same materials of which the printing rollers are formed, namely, glue and treacle. The lecturer's table was crowded with some of the most splendid specimens of china services that we have ever seen; also with antique vases and modern imitations, particularly some of a very cheap description, of which Mr. Cowper was instrumental in inducing the manufacture, and suggested the mode of ornamenting them; whilst the area in front of the table was covered with superb specimens of Singer and Company's Alhambra Mosaics, from their manufactory at Vauxhall. This patent invention consists in overlaying a slab of stone or slate with variously shaped and differently coloured pieces of pottery or porcelain, fixed in cement and arranged either in moresque taste or after more graceful designs. Thus cornices may be enriched, and halls, conservatories, dairies, &c. may be lined in a very splendid and enduring manner, and at a less expense, we understand, than marble. We regret that we have been able to give only a very imperfect report, of a very interesting lecture, from the circumstance of having lost our notes.

NOTES AND NOTICES.

Submarine Explosions.—We have been favoured with the following particulars of some experiments on firing gunpowder under water by the voltaic battery, tried on Saturday last at Chatham:—1. A rough fir vessel, 5 feet long, 3½ feet wide, and 2½ feet deep, was previously sunk opposite the Gun-wharf, to represent the wreck of a ship, having a ring and lines attached to it, which are supposed to be placed by a diver after the vessel has been sunk. 2. A charge of 40 lb. of powder was let down from a boat and hauled into close contact with the supposed wreck, by means of the lines and ring above mentioned. The coil containing the conducting wires, one-fifth of an inch in diameter, by which this charge was fired, was veered out to its whole length of 500 feet, from the same boat. 3. On the signal being given from the boat by a bugle to denote that all was ready, the signal to fire was made, also by the bugle. The explosion succeeded admirably. A column of water was thrown up by it, and the fragments of the vessel came up to the surface. 4. Three charges, each of 5 lb. of powder, were sunk at the distance of about 30 or 40 feet from each other, opposite to the Gun-wharf, having a pair of connecting wires 150 feet long, attached to each. The ends of these wires were soldered together by threes, and brought to the two poles of the voltaic battery, which had previously been removed from the boat after the first operation, and placed on the wharf, by which the charges were fired simultaneously, after two bugle sounds as before. Two of the three charges were exploded simultaneously, and the third was prevented from doing so by a fracture in one of the conducting wires. The battery used was of Professor Daniell's improved construction. The wires in the last experiment were common copper bell-wires, about a sixteenth of an inch in diameter which were only used from not having any more of the former description. The experiments succeeded perfectly, and to the great delight of thousands of spectators. As we stated in our last, they were preparatory to blowing to pieces the wreck of the *Royal George*, which sank at Spithead, in 1782, and which has a number of very valuable brass guns, of large calibre, on board of her, all of which will be recovered after the demolition of the wreck.—*Maidstone Journal.*

Ultramarine.—Till a few years ago, every attempt failed to make ultramarine artificially. At length, in 1828, M. Guimet resolved the problem, guided by the analysis of MM. Clement and Desormes, and by an observation of M. Tassaert, that a blue substance like ultramarine was occasionally produced on the sandstone earths of his reverberatory soda furnaces. Of M. Guimet's finest pigment, I received a bottle several years ago from my friend M. Merimee, secretary of the *Ecole de Beaux Arts*, which has been found by artists little, if any, inferior to the lazulite ultramarine. M. Guimet sells it at sixty francs per pound French, which is little more than two guineas the English pound. He has kept his process secret. But M. Gmelin of Tubingen has published a prescription for making it, which consists in enclosing carefully in a Hessian crucible, a mixture of two parts of sulphur and of dry carbonate of soda, heating them gradually to redness till the mass fuses, and then sprinkling into it, by degrees, another mixture of silicate of soda and alluminate of soda, the first containing 72 parts of silica, and the second 70 parts of alumina. The crucible must be exposed after this for an hour to the fire. The ultramarine will be formed by this time, only it contains a little sulphur, which can be separated by means of water. M. Persoz, Professor of Chemistry at Strasbourg, has likewise succeeded in making an ultramarine, of perhaps still better quality than that of M. Guimet. Lastly, M. Robiquet has announced that it is easy to form ultramarine, by heating to redness a proper mixture of *kaolin (China clay), sulphur, and carbonate of soda.* It would therefore appear, from the preceding details, that ultramarine may be regarded as a compound of silicate of alumina, silicate of soda, with sulphuret of sodium; and that to the reaction of the last constituent upon the former two, it owes its colour.—*Ure's Dictionary of Manufactures.*

Pantocratic Microscope.—In one of the late sittings of the Athénée des Arts, M. Laisnée read a report on a new microscope, called the Pantocratic Microscope, invented by Professor Alexander Fischer, of Moscow, and constructed by Chevalier, our well-known optician and mathematical instrument maker. By this new microscope, the observer can, by simple and almost imperceptible movements, vary the magnifying power from 270 to 550, without in any degree obscuring the object, and the degree of enlargement is registered on the body of the instrument. This is important, because it saves the operator from the necessity of changing the different parts of the microscope when he desires to study the same object under different degrees of magnitude. The Athénée fully adopted the conclusions of the report, and gave its entire approbation to the instrument.—*Athenæum.*

Sizes of Types.—The sizes of types cast in this country vary, from the smallest, called diamond, of which 250 lines are contained in a foot length, to those letters employed in placards, of which a single letter may be three or four inches high. The names of the different letters and their dimensions, or the number of lines which each occupies in a foot, are stated in the following table:—

Double Pica	41½
Paragon	44½
Great Primer	51½
English	64
Pica	71½
Small Pica.	83
Long Primer	89
Bourgeois	102½
Brevier	112½
Minion	128
Nonpareil	143
Pearl	178
Diamond	205

Razor sharpening Paste.—An excellent powder for applying to razor strops, is made by igniting together in a crucible equal parts of well dried copperas with sea salt. The heat must be slowly raised and well regulated, otherwise the materials will boil over in a pasty state, and the product will be in a great measure lost. When well made, out of contact of air, it has the brilliant aspect of plumbago. It has a satiny feel, and is true *fer olegiste*, similar in composition to the Elba iron ore. It requires to be ground and elutriated; after which it affords, on drying, an impalpable powder, that may be either rubbed on a strop of smooth buff leather, or mixed up with hog's-lard or tallow into a stiff cerate.—*Ure's Dictionary of Manufactures.*

The Aellopodes.—A curious specimen of mechanical ingenuity, bearing the above title, is at at present exhibited at Lowther Rooms, Strand. It is a carriage for travelling without horse or steam, propelled solely by the traveller's own weight, and is the invention of Mr. Nevis, a native of Cambridge. Its structure is light and elegant, and any persons may, on common roads, propel themselves at the rate of between twenty and thirty miles an hour, and on railroads it might be worked with incredible velocity. The chief object of its inventor is, that it might be employed to take up the cross mails, whereby he calculates that a very large saving would be effected by the post-office.

Errata.—In report of Mr. Brande's lecture on steel, p. 431, col. 1, line 25 from bottom, for "$\frac{1}{20}$," read "$\frac{1}{15}$." Col. 2, line 29 from bottom, for "stratification," read "steelification." In the report of Mr. Brayley's lecture, p. 448, sixth line from the end of the report, for "distinctly," read "distantly."

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 6, Peterborough-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

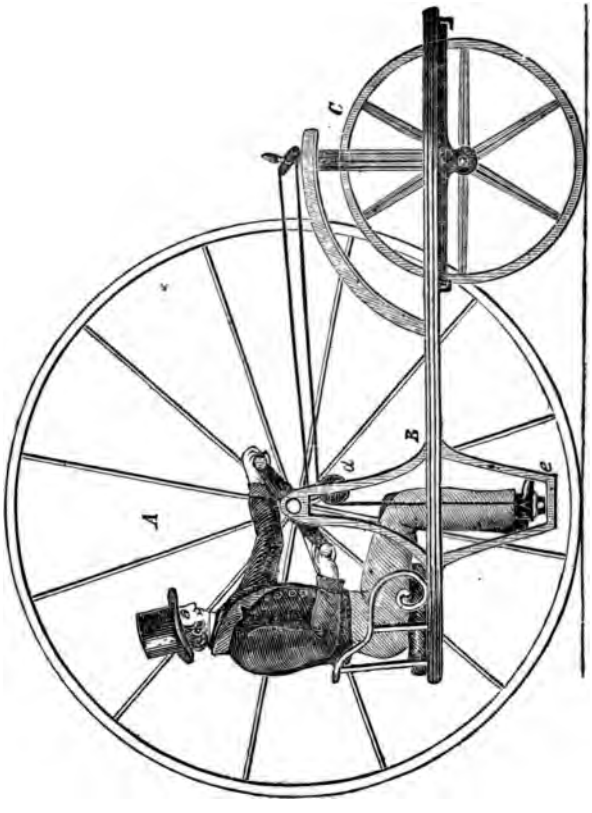
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 818.] SATURDAY, APRIL, 13, 1839. [Price 3d.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

MR. BADDELEY'S MANUMOTIVE EXERCISING CARRIAGE.



ON MANUMOTIVE AND PEDOMOTIVE CARRIAGES.

"What a delightful thing's a turnpike road!
So smooth, so level, such a mode of shaving
The earth, as scarce the eagle in the broad
Air can accomplish, with his wide wings waving."
BYRON.

Sir,—It is a common remark with many persons that *Velocipedes* have had "their day," and a good run they had of it; latterly, however, they have been altogether at a discount.

But mechanical men will have their "hobby," and we occasionally meet with some one of these numerous contrivances for aiding and extending the locomotive powers of man, wending their solitary way through unfrequented roads, only venturing

"To take a quiet ride in some green lane;"

as if the owners were more than half ashamed of their production or of its performances.

This subject has just now received a slight resuscitation, from the circumstance of a Mr. Revis, from Cambridge, exhibiting, at the George Hall, Aldermanbury, a manumotive carriage which he names "*the Aellopodes*." Beyond the *name*, there is little novelty in Mr. Revis's contrivance; it consists of two large driving wheels, urged round by two cranks, acted upon by treddles. The rider's weight being thrown alternately on each of the treddles, causes rotation of the wheels, the direction of the machine being effected by a guide wheel in front; this plan has been often tried under various modifications, but not having been found to realise any practical advantage, it has in almost every case been abandoned. The last experiment which I happen to be acquainted with, was made by Mr. Richard Merryweather, who, about eighteen months back, constructed a machine in every respect the counterpart of that now exhibiting as *new* by Mr. Revis, except that the driving wheels were not quite so large. I have had opportunity afforded me of testing the capabilities of this apparatus, and am bound to confess that it affords a species of gymnastic exercise that is highly beneficial and agreeable, if taken in moderation, but if travelling be the object, I should prefer the "marrow-bone stage."

It would appear to be a favourite *scheme with inventors of this class to employ treddles as a mode of communi*cating motion to the driving-wheels, and so to make use of the rider's weight for the motive power. I have always been inclined to consider this method as objectionable; if personal gravity is to be the propelling power, it should be applied to the periphery of a wheel similar in its construction to the tread-mill,* and connected with the axle of the driving wheels by toothed gearing. By "such a getting up stairs" direct circular motion would be obtained without the intervention of cranks or treddles, which always inevitably entail a certain loss of power.

While treating of this subject in some of your previous numbers (635 and 690), I strongly advocated a sitting posture for the rider, and cranks worked by hand,* in preference to feet-worked treddles. The accompanying sketch exemplifies the manner in which this idea could be carried out, and I flatter myself that this arrangement offers several advantages over those of Mr. Revis and his numerous predecessors. One wheel is omitted in the sketch, in order to show with more distinctness the working parts in detail.

A represents a pair of light wheels six feet in diameter; B is a frame-work of wood rounded at either end, and suspended from the axle of the driving-wheels. At one end of the frame a seat is provided, the other being occupied by the guide wheel C, about two feet six inches in diameter.

The axle of the driving wheels is formed into two cranks either at right angles, or, what is perhaps better, opposite to each other. The party using this method of conveyance occupies the hinder seat, and by turning round the cranks with his hands, drives the carriage forward with a speed proportionate to the labour exercised. There is a cross head on the vertical spindle of the guide wheel, from which proceed two lines, which passing over the pullies at *d* are at-

* I am aware that considerable prejudice, unfortunately, exists against this application of power, from its general employment as a mode of corporeal punishment in our gaols. Her Majesty's ship *Powerful*, Captain Napier, has, it seems, lost several men by desertion, and it is at this time found impractical to complete her crew for active service. This is reported to be owing to the adoption of some novel mode of propelling the ship by a machine resembling a tread-mill, which "Jack" thinks degrading as resembling the labour of *convicts*, and not that of a sailor's native element!

tached to either end of a balanced lever at *e*. The feet resting on this lever effects the guiding of the machine; the depression of the right foot inclines the wheel and turns the carriage to the right, and the left foot to the left, in proportion to the quantity of deflection.

In this manner a considerable speed may be maintained on good hard level roads for a short time; but by the employment of a pinion on the crank axle, and a spur wheel on the axle of the driving wheels (which was my original proposition), the speed will be diminished, but motion will be obtained with much greater ease and comfort to the rider.

The power applied to cranks by the hands is more continuous and uniform than can possibly be obtained by treddles; the action, too, as a gymnastic exercise, is much more advantageous, opening the chest and giving tone and elasticity to muscles not sufficiently called into action by ordinary occupations, while the daily necessary act of walking sufficiently employs the muscles of the lower extremities.

If a second traveller is taken up in the foregoing machine, he sits at B opposite to the driver, and may assist him in turning the cranks, but must not interfere with the guiding.

Although the real utility of any contrivances of this kind must ever be very limited, yet as an amusing and healthy recreation they strongly commend themselves to our notice, and this must be my excuse for thus intruding on your columns.

I remain, Sir,
Yours respectfully,
WM. BADDELEY.

London, March 27, 1839.

VARIOUS METHODS OF ENGRAVING AND PRINTING DIAGRAMS, &c. FOR TEMPORARY PURPOSES.

Sir,—In several late numbers of the *Mechanics' Magazine*, papers have appeared upon various methods of printing. My attention has been directed at different times to the same subject, not with the hope of producing any improvement upon the art *generally*, but simply with the view of enabling a person to multiply *roughly* copies *of any particular subject. My aim has been principally to contrive a plan for throwing off* a number of copies of diagrams for the illustration of lectures, in order that they might be distributed among the class. My attempts have been imperfect and rude, but with the hope that they may afford hints to others I communicate them. I suppose almost every one is aware of the old method of producing prints from the leaves of flowers, trees, &c., viz., by dabbing them between two balls covered with printing ink, and then pressing them between two pieces of damp paper placed in a fold of flannel. I name this, however, as it may be of service. Diagrams may be multiplied by any of the following methods: Cover a plate of metal or wood with white wax, and let the surface be perfectly smooth. Having traced the drawing, if copied from another, on tracing paper with a soft lead pencil, transfer it to the wax by laying the tracing paper on it with the drawing downwards, and then rub the back with a piece of ivory or hard wood. The drawing thus transferred must then be etched in the wax with a point, and impressions may then be taken either by placing a sheet of damped paper upon it when inked, and rubbing the back with a rubber of folded cloth, or by a rolling press or printing press. When I tried this method I thought I had made an original discovery; but the *Saturday Magazine* of a month or two since, contains the information that such a method has long been practised by the Chinese. Instead of wax, a harder composition of rosin, pitch, and shellac might be used. While speaking of wax printing, I may mention that I have used white wax to produce prints from medals, coins, &c. I knead the wax till quite soft; press it on the medal and let it remain till quite cold; remove it and ink it with printing balls. Impressions may now be taken on damped paper, the finger covered with a cloth being rubbed on the back of the paper, or the wax cast pressed down on the paper previously laid on some folds of soft flannel. A somewhat similar method is proposed by Baker in his *Essay on the Microscope*, but he uses sealing wax. I send some of the *first* rude trials with soft wax from a coin for your inspection, merely to show that there may be occasions when the plan would be useful.

Another method which I have tried is with tin-foil. The foil is placed upon a

book covered with rough calf; the writing, &c., executed as usual, but with an ivory style, with pretty strong pressure. The result is, a reversed and elevated copy on the other side. The foil may then be cemented to a block with a cement of glue and chalk, and impressions taken by gentle friction, on the back of the damped paper, with a rubber of folded cloth, or by pressure. The difficulty in this method is to give the lines a sufficient elevation to prevent the ink roller from coming in contact with the depressed parts, and also to get a perfectly level surface. However the hint may be useful.

Another method, when the lines are required light and the ground dark, is this:—Trace the drawing, if a copy, on tracing paper, with a soft lead pencil; transfer this, as in the wax printing, to a piece of thick card board damped. Dry the card and trace the line *deeply* with an ivory point. The card may now be used to print from, either in the rolling press, or, if glued on a block, in the common printing press, or impressions may be taken off by friction. I have little doubt also that a cast in metal might be taken from a card thus mounted, by the French method of forming medallions *en cliché*. I send a specimen, with the block, of this method, copied from a drawing in a late number of the *Mechanics' Magazine*. The whole process of copying, transferring, and tracing on card occupying not much more than a quarter of an hour. Another method, which I have tried with effect, was suggested by a correspondent some time since in your Magazine, viz., by employing lantern horn. The drawing, if a copy, is traced on the horn with a point, the horn being laid upon the drawing, and the plate of horn can then be used in the rolling press as a copperplate. It is my intention soon to try the method of printing from type with a roller covered with leather, instead of a press, as suggested in the article on China in No. 782 of your Magazine—a plan which, I believe, has been long used by strolling players for printing their hand-bills. Such a cheap and simple plan would be of much service to lecturers at Mechanics' Institutions, to enable them to place in the hands of their auditors, with very trifling expense and *trouble, a syllabus of their lectures and a glossary of terms used.* The benefits attending this are sufficiently obvious. While on the subject of Mechanics' Institutions, I would observe how valuable would be a good set of *working drawings* of various apparatus, drawn to scale, to enable a dexterous mechanic to construct, at his leisure hours, for himself or the Institution with which he was connected, such apparatus. I much wish something of the kind were published.

I am, Sir,

Yours respectfully,

N. S. HEINEKEN.

Sidmouth, March 30, 1839.

SIDE MOTION (OR ROCKING) OF RAILWAY ENGINES EFFECTUALLY PREVENTED.

Sir,—My attention having been drawn to the lateral and shaking motion of engines upon railways, and believing it to be in proportion to the weight of the cranks and gearing, and the position in which the outside cranks, if any, are placed, I made a small model of the engine crank shaft with two wheels upon it, in the proportion of one inch to the foot, which I placed upon two strong upright wires, the wires made fast in a piece of board. I attached a weight to a string wrapped round the middle of the crank shaft, for the purpose of giving a certain degree of velocity to the crank and wheels, by falling a certain distance, say from the table to the floor. The weight I attached would turn the shaft and wheels 75 seconds, and the swing of the cranks produced *a lateral and oscillating motion* sufficient to cause the model to move, or jump, across the table on which it was placed. I then placed a weight on each wheel sufficient to *balance the cranks*, and with the same weight to give motion, and travelling the same distance as in the first case would turn the crank shaft and wheels, although heavier than before, 90 seconds, and the model stood steady where it was placed upon the table.

I submitted my experiments to the Engineers of the London and Birmingham Railway, who, instructed by the Directors, ordered one of the Company's engines (the Brockhall, at that time under repair at Mr. Middleton's, the Vulcan Iron Foundry, Birmingham,) to have balance weights applied to it, according to my plan, and under my superintend-

ence. The engine when set to work, with the balance weights on the wheels, had one uniform steady pull at its work; the side sway was gone; it run equally steady, whether it made 6 or 160 strokes per minute, which is not the case with railway engines generally, for the greater the speed the greater the snatching and swinging motion. After the engine had worked seven weeks, and had acquired the reputation of a very steady engine, I, with the consent of the engineers of the railway, removed the *balance weights* from the wheels, and found the same snatching and swinging motion with this engine as is common to all locomotive engines of the usual construction; I found that the engine, when running at or upwards of 22 miles per hour, would advance and recede from and to the tender from three-quarters of an inch to an inch every stroke of the engine, and proved the advantage of the balance on the engine equal to the effect on the model. Persons acquainted with railway locomotion will, from the foregoing statements, readily see the great and many advantages to be derived from so simple and yet so effective an arrangement.

Yours respectfully,

G. HEATON.

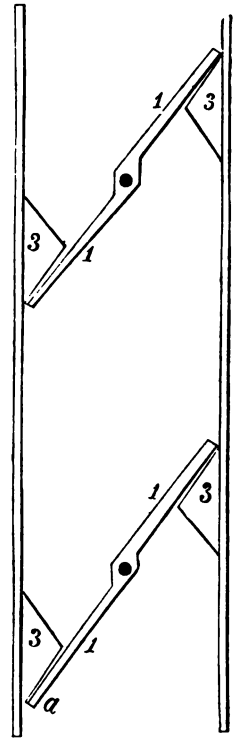
Shadwell-street Mills, Birmingham.

P. S.—Since writing the above, I understand the spirited and enterprising manufacturers of the Brockhall engine, have judiciously applied my balance weights to some new locomotive engines lately sent out by them.

G. H,

LIEUT. WALL'S MOVEABLE DIAGONAL FLOAT-PADDLE WHEEL.

Sir,—Having observed in your number of the 9th inst., a drawing and description of a paddle-wheel with oblique floats, patented by Lieut. Hall, to which is added a drawing of another invention, viz.: a wheel fitted with two rows of diagonal floats, of which no description is given, and which is a mechanical contrivance essentially different from the former, being of a different construction, acting on a different principle and producing a very different result—allow me to state for the information of your readers, that in the early part of April, 1838, I presented the model of a wheel of a *precisely similar construction, to the double wheel given in Mr. Hall's* diagram to a public company, and that it was submitted by them to their engineer. So that the fact of its being in existence and in my possession at that period, is placed beyond a doubt—whereas, the specification of Mr. Hall's patent is dated June 18, following. But to prove the invention was original in my mind, I will state, with your permission, the successive steps and chain of reasoning by which that mechanical combination was produced. On reference to the accompanying diagram it will be seen, I at



the first contemplated a wheel having an oblique paddle, or float, moveable on a vertical axis, the length of which (float) being greater than the breadth of the wheel, the ends of it (when closed) abutted against the triangular pieces 3. 3. 3. 3 attached to the inner side of the rim, with which the wheel was fitted. The float was kept in the diagonal position (when out of the water) by its weight acting on a screw thread on the inner end of the axis. Now it is clear, that as

the wheel revolved, the lower end (*a*) of the float would first enter the water, and would be retained firmly in the diagonal position in consequence of the lower half of the float presenting a greater surface for the water to act on than the other, owing to a part of the latter being covered by the triangular support. The float thus circumstanced together with the rims of the wheel would form a bucket of this shape, of which M represents the mouth,

M

by which a much better hold of the water would be obtained, than by a transverse float without sides, much less an oblique one. But as the wheel continued to revolve, that part of the float which was lowest on entering the water would be the first to emerge—consequently, the pressure being removed from it, that operating on the lower half would preponderate, and turn the float in a fore and aft direction, or in other words, remove the bottom from the bucket, so that no water could be lifted by it. This wheel I had completed as far as it now is about the latter end of January, 1838, or beginning of February; but having a great objection to applying machinery composed of moveable parts, in a situation so exposed as the wheel of a steam-vessel, it occurred to me the floats might be dispensed with altogether, simply by enlarging the triangular pieces until their angles should reach half way between the sides of the wheel; for in that case the direct passage of the water through the wheel would be completely impeded, by which it would be forced into a tortuous and circuitous channel, so that having to traverse a distance greater than the arch or segment of the wheel contained between the points of immersion and emersion, the water could not escape from being acted on by the triangular pieces. Whereas, in the oblique wheels, patented by Mr. Hall, of Basford, as well as those by Lieut. Hall, a considerable loss of power would be sustained, by the water being able to recede from the stroke of the oblique float. Having succeeded thus far in my invention, an unforseen difficulty arose from the space enclosed between the rim of the wheel and the sides of the triangular pieces being liable to lift water, and so occasion a loss of power, to obviate which I removed the rim from the wheel altogether, by which it was at once converted into a wheel having a double row of diagonal floats, a model of which, as before stated, I laid before a public company.

Now, Mr. Editor, although I do not mean to deny that the same idea may be original in the minds of many persons, yet it does appear strange Mr. Hall should lay claim to an invention, the merit and principles of which he evidently does not understand.

I remain, Sir,

Your very humble servant,

ROBERT WALL, Lieut., R.N.

London, March 24, 1839.

REPORT OF THE COMMITTEE OF THE FRANKLIN INSTITUTE ON THE EXPLOSIONS OF STEAM-BOILERS.—PART II.—REPORT OF THE SUB-COMMITTEE ON THE STRENGTH OF MATERIALS EMPLOYED IN THE CONSTRUCTION OF STEAM-BOILERS.

[From the *Franklin Journal.*]

(Concluded from page 14, No. 817.)

Effects of Piling into the same Plate, Iron of different degrees of fineness.—It is believed to be a practice, not unknown among the manufacturers of boiler iron to combine into the same slab, and subsequently to roll *into plate, iron of different qualities.* In *such cases the want of homogeneousness* may manifest itself in a variety of ways. The different kinds may not be equally welded together throughout, and may consequently exhibit flaws at the surfaces of lamellation. They may be very unequally extensible under the same force, and while the outer ply of metal may, in turning a

flanch, remain unbroken, the interior one may be greatly reduced in strength. They may be of different specific gravities and mislead the purchaser, who looks only upon the exterior face of the plate, and judges of its value by the good appearance of the latter, and the weight of the whole per square foot under a given thickness.

By a reference to table XXXIII., in experiments on bars 39 and 41, it will be seen that a considerable defect, of the nature above alluded to, was exhibited, and the low results given in those cases, (40600 and 37700 lbs. per square inch) afford conclusive evidence of the bad quality of boiler plate in which such defects of welding between the laminæ exist.

In table XLIX., experiment 16, another example of the same kind occurs, in which a decided difference of appearance in the fracture showed itself between the interior and exterior folds of the metal.

Effects of the Rivets on the Total Strength of Boilers.—In whatever manner the parts of a steam boiler are united, the rivets which form the junctures being substituted for portions of the metal cut away to receive them, are of necessity so much deduction from the strength of the entire sheet, and unless we can suppose that the strain brought upon the rivet by the manner of setting it, when hot, and in that state making so close a bearing as, when cold, to contract and create a pressure that shall furnish an adhesion by friction between the overlapping surfaces, equal in amount to the strength taken away by the line of rivet holes, we cannot in computing the absolute strength of any steam boiler, safely rely on more than the portion of metal which remains in the intervals between the holes. That the requisite amount of friction could not, under the circumstances which practice assigns to the case, be produced in the manner supposed, is easily demonstrable, since, for that purpose, the friction on two square inches of surface, (the amount which on each side of the line of rivets could possibly be available for this purpose,) must be equal to the strength of the part cut away, which seldom falls short of $\frac{1}{8}$th of an inch. If we could suppose the rivet of this size so strained by hot working and shrinking as to exert $\frac{3}{4}$ of its entire strength or what would be just sufficient to produce in it a permanent elongation, then as its area of section would be .3068 of a square inch, admitting the iron of which it was made to be capable of bearing 55000 lbs. to the square inch, we should have an actual pressure of $55000 + \frac{3}{4} \times .3068 = 11249$ pounds to be distributed *over 4 square inches, giving for each of the two sheets 5624 pounds of pressure*, the *friction* of which s to counteract the cutting away of $\frac{5}{16}$ of its substance.

If we suppose the plate to have the same strength per square inch as the rivet, and $\frac{1}{4}$th of an inch in thickness, two-thirds of the strength of the part cut away ($\frac{1}{8}$th of an inch wide,) would be 5726 pounds. From this it is evident that for a weakening of 5726 pounds, we have only the compensation of the *friction* produced by a pressure of 5624 pounds. That fractures not only do take place along the lines of rivets when violent explosions occur, but that incipient fractures and permanent elongations are presented at the spaces between the rivet holes, is evinced by the appearance of the holes themselves elongated by strains and especially by overheating in the vicinity of the juncture. Examples of this are found in table XCVIII.

In a piece of boiler iron which had been some years in use, and which from overheating, in consequence of the collecting of a quantity of sediment in the part immediately above the fire, had become locally swelled into a protuberance reaching nearly the breath of a sheet and from nine to ten inches in the direction of the curve, the rivet holes on both sides of the sheet, opposite to the protuberance, were found to be elongated as in the following table. All those on the side nearest to the summit of the protuberance, were found to have cracks running out in different direction, and in some cases, nearly traversing the entire space between the two adjacent rivets.

Within half an inch of the first five rivets, and parallel with their line, a strip *a*, 1 inch wide, was cut from the piece of boiler, and tried at several filed sections. The report of these trials will be found it Table C. from which it will be seen than the portion nearest to the protuberance, and which had been reduced in thickness by the stretching, possessed much less strength *per square inch* than that which was still of the original thickness of the sheet. The surface of this bar, when the oxide had been removed, presented a distinctly spongy or *honey-comb* appearance, having many minute cells, which being developed by the shears were seen to be nearly filled up with oxide. The committee took an opportunity of making direct trial of the diminution of strength by rivetting. A bar of iron $\frac{9}{10}$ths of an inch wide and .134 inch in thickness was rivetted together at a lap 6 six inches long, by 12 rivets, each .205 in. in diameter, in two rows along the length of the bar, but alternating with each other in a zigzag course, the rivet near one edge being about one-third of an inch in advance, along the length, of the preceding one on the opposite edge.

TABLE XCVIII.

Effect of unequal strains on rivet holes.

No. of rivet holes.	Position of the rivet holes.	Length of the major axis of the rivet hole lying in the direction towards the swelled portion.	Length of the minor axis transverse to the swell, and in the line of the series of rivets.	REMARKS.
		Inch.	Inch.	Refer to fig., page 238.
1	At the part of the plate nearest to the swelling.	.750	.700	The centre of the rivets in this piece of boiler iron were 2 inches apart. Two cracks proceeded from this hole, one towards the interior of the sheet 4-10 inch long, the other towards the next rivet, 9-10 inch long.
2	Do.	.735	.650	An oblique crack proceeding gradually towards the interior but more rapidly to the next rivet, 9-10 inch long.
3	Do.	.740	.700	Crack proceeding towards the next rivet ⅘th inch in length.
4	Do.	.705	.670	Two cracks proceeding in opposite directions, one 2-10 inch, the other 3-10 of an inch.
5	Do.	.750	.705	These cracks proceeding from the periphery of this hole, each from 3 to 4 tenths of an inch in length.
6	At the part of the plate most remote from swelling.	.725	.700	No cracks observable.
7	Do.	.715	.700	Ditto
8	Do.	.675	.645	Ditto
9	Do.	.690	.665	Ditto
10	Do.	.665	.665	This hole appears to be the only one which retains its original size and shape.

The above described compound bar broke with an oblique section 1.05 inch long, passing through two rivet-holes.

The *strength* computed on the area of *cross* section was 52580 pounds, which reduced to the area of the actual oblique section is 45068 per square inch.

The same bar afterwards broken at a point 6 inches from the foregoing fracture, exhibited a strength of 66027 pounds. If we conceive the diameters of two rivets deducted from the cross section there remains but .49 of an inch in the breadth of the strap of iron which supported an effective strain of 6341 pounds. But the diagonal section of fracture had an area, after deducting the diameters of two rivet holes, of .64 + .134 =08576, whereas at the place of fracture, 6 inches distant, the area was .113529. The *effective strain which broke the bar* in this latter case was 7496 lbs. Applying this as a standard to the actual section of fracture at the rivets, we have the following calculations:—

1. For the weakening effect of cutting away the metal at the rivets; .113529 : .1407 : : 7496 : 9290=the effective strain which would have been borne by a section of this metal, 1.05 inch wide and .134 inch thick, had none been cut away to make room for the rivets. But the actual area left was only .08576. Hence .113529 : 08576 : : 7496 : 5662 which ought to have been borne if no strengthening influence had been exerted by the rivets. The difference, or 9290 —5662=3628, is the reduction of strength by cutting out the two cylindrical holes; but the actual effective strain was 6341. So that the weakening effect is in fact 9290—6341=2949.

2. The strengthening effect of the friction is 6341—5662=679.

Construction of Cylindrical Boilers and Flues.—In connexion with the subject of rivetting it may be remarked, that unless a due regard to the form of the parts of a boiler be observed in constructing it, and a due attention to the rivet holes in the different pieces, the strains incidental to the boiler in its regular use may be made more dangerous than that which would arise from the mere elastic energy of the steam alone. The usual practice in constructing cylindrical boilers and flues is to make the portions in the form of frustra of cones, the smaller end of one of which entering the larger end of the next, is rivetted in such a manner as to turn all the outer laps in the direction of the *fire end* of the boiler. It is evident that in such a construction the several plates which constitute a single ring of the boiler must have the lines of rivets along their *ends* placed in converging *right lines* and those along the sides or longest edges, in circular arcs of different radii. If in any case these lines are inconsistent with the positions of others to which they are required to conform, the holes must either be rimmed out, or the sheet unduly strained in attempting to force a conformity of positions.

In every case in which a just construction by the aid of previous calculation is obtained, the centres of the rivet holes are the points from which our calculations must commence.

It is obvious that the diameter of the cylindrical, or rather of the compound conical, shell, must constitute one element of the calculation, the breadth of the sheets a second, and the thickness of the metal a third. From these data may be found the radii of the curves in which are to be placed the rivets, and also the convergency of the two straight lines along the two ends of each sheet. The difference in the exterior diameters of the two ends of each frustum must at their respective rivet-lines be equal to twice the thickness of the metal. The larger arc for the rivet holes must manifestly be described by a longer radius than the smaller, and the difference of the two radii is the breadth of the sheet between the curves.

The larger radius will in every case be found *by adding to the mean exterior diameter of the boiler in inches, the thickness of the plate in the same denomination, multiplying the sum by the breadth of the plate, and dividing the product by twice the thickness of the plate.**

Effects of use and long exposure on the strength of boiler-iron.—This topic may be regarded as one of the most important which came under the notice of the committee. To treat it in all its bearings would demand far more of time and means than were at our disposal.

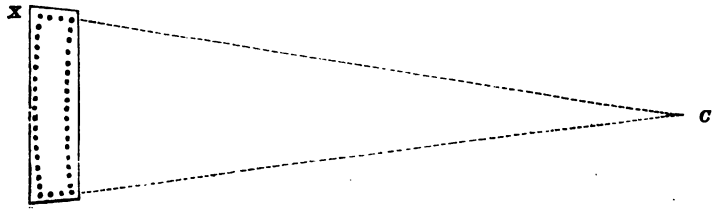
Table C. (*Frank. Jour.*, vol. xx, p. 106,) contains the results of trials on four bars or strips cut from pieces of plate which had been long in use, and which were more or less visibly affected by the strain, or by the action of water and steam to which they had been subjected. They were cut lengthwise and crosswise respectively from the sheets out of which they were taken, one bar in each direction out of each sheet.

---

* Thus putting D=the exterior diameter of the boiler,
t=the thickness of the metal,
b=the breadth of the sheet between the two arcs of rivets,
A=the length of the greater arc which will reach round the larger end of the frustrum,
a= " less Do.
R=the radius of the greater arc,
r= " less; so that $R-r=b$,
also $\pi=3.1416$.

Then, since the arcs are similar, $A : a :: R : r$ and $A-a : A :: R-r : R$. But $A=\pi (D+t)$ and $a=\pi (D-t)$. Hence, $A-a=\pi (D+t) - \pi (D-t) = 2 \pi t$. Hence, by the above proportion and putting b for $R-r$ we obtain $2 \pi t : \pi (D+t) :: b : R$, from which results $R=\frac{b(D+t)}{2t}$, and $r=\frac{b(D+t)}{2t}-b$.

As there must be the same number of rivet holes in each arc, a knowledge of the lengths of the respective arcs and of the number of rivets to be placed round the boiler, determines their distances from ach other, on the two curves respectively. The accompanying figure represents the arrangement of the rivet-holes in a plate of metal adapted to constitute a part of a cylindrical boiler, with the centre c, and radii cy and cx of the two arcs of rivet-holes.



The two strips, Nos. 245 and 246, taken from a specimen of plate which had been burst, are represented in position by the dotted lines in the accompanying sketch. The length of the specimen is the original breadth of the sheet and lay as usual in the direction of the length of the boiler, 30 in. in diameter, from the bottom of which near the fire-end this piece was taken. Hence the shorter strip (*a*) is a length sheet strip, and the longer (*b*,) a cross sheet strip.

Agreeably to what has already been shown, the former possessed the greater strength, but the second experiment upon it made at the point *m*, where the swelling commenced, was found, as shown in the table, considerably weaker than the sections near the two ends of the strip.

The amount of the swelling on this specimen of iron may be seen by the two sketches, page 239, one of which is longitudinal and the other transversal, and the lengths of the ordinates, from lines at right angles to each other, and both passing over the centre of the swelled part, at *b* will be

found in the accompanying table. The ordinates on the inside or concave part of the plate, commence fig. 1 from the centre of the rivet holes nearest to the place of rupture *b*. The points on the two axes were 1.075 inches apart.

TABLE XCIX.

No. of mark on the line lengthwise of specimen.	Ordinate or distance of the line from the bottom of the cavity in inches.	REMARKS.	No. of mark on the line transverse to the curvature of the piece.	Ordinate or distance from the co-ordinate to the inner surface of the swell.	REMARKS.
1	.150		1	.700	
2	.500		2	1.425	
3	.945		3	2.200	
4	1.430		4	2.720	
5	2.000	The rupture was opposite to these marks and the distances could not be measured with the same precision as the rest.	5	2.960	The rupture was opposite to these marks.
6	2.075		6	2.320	
7	2.350		7	1.745	
8	1.975		8	0.940	
9	1.870		9	0.390	
10	1.600		10	0.000	
11	1.360				
12	1.115				
13	0.940				
14	0.665				
15	0.520				
16	0.395				
17	*0.350*				
18	*0.265*				
19	*0.145*				
20	*.080*				

The original distance in the line *a c*, Fig. 1, was 22½ inches. The length of the curve *a b c* by actual measurement was found to be 24.6 inches. Hence, the extension of the metal in this direction had been 2 1-10 in. in 22 5-10 or $\frac{1}{10}$.$_7$ of the whole length.

Fig. 1.

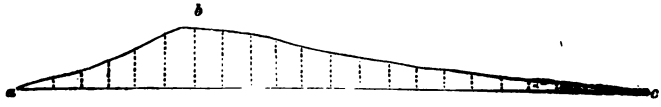
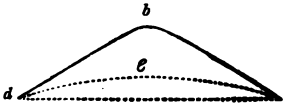


Fig. 2.



The length in the direction of the curve *d e f*, fig. 2, was originally 10.6 inches. Actual measurement over the curve *d b f*, gave the length 12 inches, showing an elongation of fibres in this direction equal to 1.4 inches in 10.6 or $\frac{1}{7}$.$_3$ of their whole length. This greater extension of the fibres in the longitudinal direction of the sheet, accords with what has already been proved by direct trials on bars cut from new plates.

The two specimens, Nos. 97 and 98, table C., were deeply corroded in certain parts, indicating the existence of local chemical actions arising probably from inequalities in either the purity, or the mechanical structure, of the sheet.

In both sets of the above trials on old boiler-plate it will be observed that though the mean strength is low, being under 50000 pounds per square inch, yet the principle is still preserved which assigns a greater tenacity in the longitudinal than in the transverse direction of the rolling. The difference, in this respect, between Nos. 245 and 246 is 50017—48515 or 3 per cent. of the strength of the transverse strip.

Between Nos. 97 and 98 the difference is somewhat less.

Effect of Annealing on the tenacity of Iron.—In a variety of cases the committee have endeavoured to extend the range of their experiments so as to embrace the condition of a steam-boiler which without being exploded has suffered from the exposure of its fire-surface when destitute of a due supply of water, to the action of heat above redness. In a few of the trials at elevated temperatures, this point was attained or surpassed, and the subsequent trials on parts near the places of fracture in such cases, gave evidence that the condition of the metal in regard to tenacity had been altered. In the case of bar No. 13, table XXXI, it will be observed *that annealing, which in that instance was produced by the folding* over of the ends of the bar to obtain a more certain hold by the wedges, determined at once the place of fracture.

On specimens 199 B and 199 C, table CII., (*Frank. Jour.*, vol. xx, p. 110), which were wires manufactured at Phillipsburg from Juniata iron, were made several experiments to ascertain its mean tenacity, in the ordinary state of the article. On other pieces of the same wires the process of annealing at high temperatures was performed. The results show that the maximum effect of annealing on one of the sizes was a diminution of 27.5 per cent., and on the other 46 per cent. of the original strength.

In these instances the annealing was performed in a common smith's fire, without using any other precaution to defend the wire from oxidation than merely covering it with cinder.

This prevented, for the most part, any action of the air on the wire during the short time of its remaining in the fire. But to obviate altogether the objection that oxidation might have some share in producing the weakening effect, several specimens of iron were, after being carefully gauged, weighed and, having their specific gravities taken, rolled up in several folds of clean sheet iron; the ends of the folds turned over and hammered flat, to prevent access of air, and the whole then exposed for 15 or 20 minutes to the blast of a smith's fire, gradually raising it to a very high *welding heat*. In this state the package was withdrawn from the fire, often exhibiting one or two folds of the sheet iron cut through by the blast, but in no case extending to the enclosed specimens. When taken from the fire it was immediately buried in dead cinders, where it was allowed to remain until quite cold. The wrapping of sheet iron was then removed, and the specimens generally found with no visible change except a slight discolouration by black oxide of the metal,

insufficient, however, to affect sensibly the weight of the specimen.

The five trials on Nos. 224 C and 254 D were among those which had been reduced or *constricted* by straining before the specimens were annealed.

No essential change of specific gravity from annealing was detected, except in the case of a piece which had been beforehand excessively hammer-hardened. This appeared to have been slightly diminished in density by the annealing process. When the specimens treated in this manner had been previously strained nearly to the limit of their tenacity, and their original areas of section consequently much reduced, the precaution was taken to regauge them before annealing, so that we could employ the then existing areas of section, instead of the original ones, as the basis of calculation for the strength per square inch. This course was followed with Nos. 224 C and 224 D.

Calculating the strengths on the areas of these bars taken just before annealing, they were found as follows:—

Instead	of	36052	we	obtained	45090
"	"	39333	"	"	41980
"	"	35889	"	"	42700
"	"	36706	"	"	43200
"	"	38676	"	"	41980

From table CI. (*Frank. Journ.* vol. xx, p. 109,) it appears, that, computing the strength in the comparisons from 11 to 15 inclusive on the area before annealing, and excluding Nos. 1 and 3 of the series, as not made at a sufficiently high temperature to effect the purpose, we get the mean tenacity of iron, by seventeen comparisons after annealing, equal to 45117lbs. to the square inch.

In a considerable number of cases where trials were made at high temperatures, especially those above 1000°, the iron was left in an annealed state. In several of these the effect of the process is nearly as striking as where the heating had extended to the point of welding.

In other cases the difference between the strength previous to annealing, and that exhibited afterwards, was so small, that it was difficult to refer it to any other cause than the original inequalities of structure.

It will be seen that, from Experiment 3 to Experiment 11 (Table CI.) the loss of tenacity by annealing follows very nearly the order of the temperatures at which the process was performed.

That boilers do, in the course of ordinary practice, frequently become annealed there can be little doubt. The four specimens of *old boiler-iron already spoken of*, indicate clearly the existence of such a state. The mean strength of those specimens by 15 experiments was 49278 lbs., while the mean minimum strength of the four bars was 46252, quite within the range of the tenacity of iron annealed at a red heat. Hence, unless we can be certain that a boiler will be entirely secure from this process, we shall not be warranted in calculating its strength at any greater amount than about 46000 pounds per square inch, and of this amount but two-thirds can be assumed as a safe basis of calculation, being that at which permanent change of form would take place.

Your sub-committee have at length brought to a conclusion the research which has so long* occupied their attention. The foregoing pages present as concisely as the case seemed to admit, the facts which their investigations have elicited, in regard to the several inquiries, principal, incidental and subsidiary, stated in the preliminary part of this report. The great interest of the subject required that the utmost care should be exercised to prevent error. Hasty and unwarrantable conclusions were to be avoided. It has been our sincere desire to meet every just expectation in regard to the practical usefulness of the information of which we were in search. It would be presuming too far to suppose that in so extensive a mass of calculations we had escaped all error. So many steps of each process have, however, been preserved, that verifications will be easily made. Speculations, merely scientific, have been deemed inappropriate to this report, and we now abstain from swelling it with repetitions of statements already made, or with any matters not strictly pertinent to the subjects embraced within the views of the general committee.

WALTER R. JOHNSON.
BENJAMIN REEVES.

N. B.—Prof. A. D. BACHE, the remaining member of the sub-committee, being absent from the country at the time of making this report, we regret that it is impracticable to submit it to him for inspection and signature.

In the course of this inquiry we have been indebted for valuable personal assistance to several friends of the useful arts, among whom we would particularly mention the late Benjamin Say, Esq., and Messrs. James M'Crea, James Barnet and Joseph Brezinski. The last named gentleman repeated and

* This sub-committee was appointed January 4, 1831, and preparations for the experiments immediately prosecuted.—The trials of tenacity were commenced April 4, 1832. The last experiments were made January 5, 1837.

verified many of the calculations as well as aided in various experiments.

Note.—Mr. Telford has made an interesting series of experiments on the strength of wire, an account of which is found in Mr. Barlow's treatise on the strength and stress of timber, page 254.

The same gentleman made various experiments on bars and bolts of iron, detailed in the same work.

He also attended to the successive elongations of bars under different weights, and noted the amount of recoil or contraction when relieved from strain.

Captain S. Brown has also furnished to Mr. Barlow, a series of highly interesting experiments on the strength and elongation of iron bolts.

The mean result of three experiments by Mr. Brown on cast-iron was 18564 lbs. to the square inch.

Mr. Hodgkinson has published in the third report of the British Association, three results of experiments on the same material, which make its strength 17136 lbs. per square inch, while the three experiments of the committee of the *Frank. Inst.*, which were considered fair, indicated in the bars a strength of 20834 lbs.

Mr. Brunton and Mr. Brunel, have each engaged in this interesting department of inquiry and given the results of experiments on a large scale which will be found in the work of Mr. Barlow already cited.

Mr. E. Martin, formerly of the Polytechnic school, has given in the Annales des Mines, Vol. V, a series of experiments executed in France, under the orders of M. Barbé on round rods of iron, 18 or 19 feet long and 2 inches or more in diameter, made with a view, in part, to determine the recoil when released from strain, and the actual amount of elongation under each weight to which it was subjected.

In the same volume of the Annales des Mines, M. Vicat has a paper referring to, and controverting some of the positions of M. Martin, but not affecting the statements respecting the experimental operations just referred to.

In the same work, Vol. VI., are contained some interesting statements by M. Payen, respecting the manufacture of wire, in which the relative ductility before and after annealing is established.

In the Annales de Chimie et de Physique for Sept. 1833, is a valuable paper by M. Vicat, showing the influence of time on the gradual extension of wires under different weights. Each of his experiments occupied nearly three years.

The quantity by which iron extends under different degrees of tension, and on the recoil when relieved from strain, has been examined by Prof. Barlow. See Journal *Frank. Inst.*, Vol. XVI. p. 124, &c. The relation between the effect of straining and elongating a bar by mechanical means, and that of expanding it by heat, is also noticed.

ROYAL INSTITUTION—MR. CHEVERTON'S MECHANICAL SCULPTURE—PHOTOGENIC DRAWINGS—MR. FARADAY'S LECTURE ON MR. AIRY'S CORRECTION OF THE COMPASS IN IRON VESSELS.

March 22.—*The Conversazione.*—There was on the table an interesting collection of Caffre curiosities, with some very fine buffaloe horns. Mr. Cheverton sent a bust in ivory of his execution, of unusual magnitude, being one quarter the size of life. It was a specimen of his art of mechanical sculpture, and was a copy of Sir Francis Chantrey's bust of Dr. Dalton from the original model, which, it is needless to say, is as admirable in respect to likeness as to style. Specimens were exhibited of Mr. Talbot's photogenic drawings, also of photogenic writing, in which the lines were black, and consequently must have been produced by a second process of copying. This argues great fixedness of the first copy, or else great sensibility of the paper in the second copy. The effect, however, in this manner, is not yet perfect.

Great interest was excited by some photogenic drawings and etchings by Mr. Havell, an engraver, of Camden town, from an idea which was very generally entertained that they were specimens of a new application of the process, as superior in its results, as it was thought to be promising in point of practical utility. This, however, is a mistake, for not only is it recorded in Sir Anthony Carlisle's communication to this Magazine (No. 809), as having been practised by himself and Mr. Wedgewood; but Mr. Talbot refers to it "as producing pictures which resemble the productions of the artist's pencil, more than any of the others." The method is this—to paint on glass in such a manner as to produce perfect opacity for the intended lights, and different degrees of it for the several tints, and then to expose prepared paper pressed closely to the painted side of the glass, to the effect of light. Mr. Havell also covered glass with an etching ground, and then etched upon it as he would upon a copper plate, and in this way produced designs of greater precision, and more resembling engravings than anything we have yet seen.

Though the idea of using glass and covering it with an original design is not new, yet this particular style is certainly original, and is due to Mr. Havell, to whom it was naturally suggested by his profession of an engraver. Some very excellent effects may probably be produced in this way, the artist having the advantage, which he has not in a plate of metal, of introducing tints and otherwise modifying his lines by working on the other side of the glass, or by using two glasses. The art, however, can never come into competition with that of engraving in point of general excellence, for besides being incapable probably of extreme delicacy, it will certainly be very deficient in strength, from the circumstance that the paper is merely dyed, which produces a very different effect from a palpable and perfectly opaque body like printer's ink, standing up from the surface of the paper and even casting a shade; and in regard to economy, the dispensing with press work will not be thought to be an advantage when the expense of the paper is taken into the account.

The Lecture.—Mr. Faraday lectured "On Mr. Airy's correction of the mariner's compass in iron vessels." It appeared, however, in the sequel, that it was not the lecturer's

intention to elucidate the method by which Mr. Airy obtained the quantity, proportion, and position of the means of correction; for he was not empowered by him to disclose the exact mode of proceeding, lest, it was averred, serious evils should ensue from an imperfect attempt at following it. The object, therefore, of the lecture was to prove the imperious necessity of subjecting the mariner's compass in iron vessels to correction; to explain the causes of deviation; and thence to show that the correction required is of a greater amount, and in part of a different kind, from what is necessary in timber-built vessels; the error in these being sufficiently compensated by Professor Barlow's method. Mr. Faraday aided his purpose by a very ingenious arrangement. He pivoted a large oblong sheet of iron on the lecturer's table to represent an iron vessel, the centre of motion being placed abaft the midships. At a little distance above this point was placed a compass; it thus occupied the situation of the binnacle, but it was detached from the sheet of iron that it might not be disturbed by the rudeness of its movements, and yet it was magnetically acted upon, precisely the same as though it had been affixed to it, for the relative position of both was preserved. As the sheet of iron was turned round, the needle was seen to veer about in a very strange and capricious manner, showing that it was, as Mr. Faraday pleasantly remarked, a pretty sort of a tell-tale if it could tell no better tale than that.

The lecturer then proceeded to explain the cause of these vagaries, giving for this purpose, and illustrating it by experiment, some preliminary elemental information, particularly in respect to induced and permanent magnetism, as belonging respectively to iron and steel, when near to, or in contact with, a magnet. He then showed that a magnetic needle may be influenced, not only by the attraction which exists between it and a mass of iron, or rather by the magnetism which itself induces in the iron, but by the magnetism which is induced in it by that of the earth, when it is held in the magnetic position, which is nearly vertical (for London 70°,5) and inclined to the north. He showed the bearing of this fact on iron vessels, where the induced magnetism by the earth's influence must be so great, as to occasion much disturbance of the needle, and adverted to the correction provided for it by Professor Barlow's compensating plate. But iron, by long position, and by being hammered, and particularly when it is hammered whilst held in a direction parallel to the dip of the needle, contracts a permanent magnetism. This was exhibited in the case of a poker; magnetism was hammered into it, hammered out of it, and hammered into it again. In iron vessels a great deal of permanent magnetism, so caused, must exist, and it is the influence on the needle from this source, which is not provided for by Professor Barlow, that Mr. Airy has sought the means of correcting. This he has accomplished, by *adding*, we presume, to the compensating plate of Barlow, a small magnet, which being placed in the proper position with regard to the compass, corrects or neutralises the permanent magnetism of the ship. This was exemplified by Mr. Faraday, who, without aiming at any great nicety, showed that by this means the needle was rendered much more steady, on turning round the sheet of iron, than on the former occasion.

In order to obtain the proper position for the correctors, Mr. Airy appears to have followed Mr. Barlow in his method of obtaining the same for his compensating plate; that is, the head of the vessel was successively directed to each point of the compass, and each time the magnetic bearing of a distant object being taken, the difference of the bearing, as determined by the respective observations, was the amount of the deviation of the needle produced by the magnetism of the ship, for each respective point. Having obtained these data, which, Mr. Faraday states, were taken in distinct series in different parts of the vessel, Mr. Airy, we suppose, took the compass on shore, and, by repeated trials, found the right position of the correctors for neutralising similar deviations of the needle, which were purposely produced. This tentative method of proceeding would have been too operose, or rather it would have been impracticable with the vessel itself, and hence is seen the utility of taking the observations and obtaining the data just described. But a difficulty presents itself, arising from the deviation being the effect of the conjoint action of the induced and the permanent magnetisms of the vessel. The separate amount of influence of these distinct sources of disturbance were, according to Mr. Faraday, ascertained by means of observations made in regard to the horizontal intensity of the magnetic action, by the usual mode of counting the oscillations of the needle in a given time. The method of using these observations was not explained, but they furnished means, we imagine, not only for a due proportioning of the correctors for each cause of deviation, but for adjusting and distributing the respective intensities of those disturbing forces which, for the purposes of correction, were made to serve in the place of those which operated in the vessel itself. Mr. Faraday remarked in conclusion, that as every ship must have its own magnetism, the correctors for one would not answer for another.

Remarks.—The correction of the indications of the mariner's compass in iron vessels is, it appears, a process of such extreme delicacy, and such fearful risks are connected with it, that nautical men must not be entrusted with it. However that may be, in regard to Mr. Airy's method, the following mode occurs to us of so simple and practical a character, that no difficulty can attend its adoption. Though it is applicable only under certain circumstances of locality, yet these are likely to occur in cases where it is most required, and the important interests which are attached to an accurate correction available in all latitudes, may warrant a voyage in a great degree for the express purpose. It is likewise wholly devoid of scientific pretension, but it may not be the less useful on that account, and we should be glad to see opinions on it from some of the able nautical correspondents of this Magazine.

Let the circumstance of the vessel being in some situation on or adjacent to the magnetic equator be taken advantage of to ascertain the deviation of the needle for each point of the compass. Now this disturbance may be considered to be due solely to the permanent magnetism of the vessel, for its induced magnetism is neutralised by its geographical position. Let the process be repeated in a higher latitude; the *differences* of deviation then found is to be ascribed to the induced magnetism, and the proper position for Barlow's plate in respect to the compass is to be determined in the usual manner, but so that it may compensate (or indicate as may be thought proper) those differences only. Now, as the permanent magnetism is constant for all latitudes, and as its effect has been ascertained separately for every point of the compass, it is easy at any time, by making allowance for it, to obtain the necessary additional correction, and thus the perhaps precarious security of the correctors will not be required, and the delicate operation of *correcting* the deviation is dispensed with. The deviations, as ascertained for any particular place, cannot be used for every other, or for any other place, except within certain limits, but they must be determined as they are required to be known, and by a reference to the separate amounts of disturbance, as due to the induced and the permanent magnetisms; for although the latter continues the same, the former differs with the different latitudes, and has its poles reversed on opposite sides of the magnetic equator, and hence arises the necessity of having Barlow's plate, in addition to the data of correction already provided, either *to act as a continual corrector of this varying influence, or as means whereby at any time its amount can be ascertained* and the necessary additional allowance made. If perfect dependance can be placed on Mr. Airy's method of obtaining a *due* estimation of the separate causes of disturbance, why not allow for the error occasioned by the permanent magnetism, instead of attempting the delicate operation of correcting it; but probably the correction in practice is somewhat of a mixed and equivocal character, sometimes partaking unduly of one magnetism and sometimes of the other, and therefore this more certain course, of making allowances, is not available by his method; and hence also may be conjectured the reason of the alleged nicety of the process. The entire or conjoint effect may, notwithstanding, be accurate for the place, and sufficiently so for voyages, if confined to latitudes not differing much from that in which the correction is made. The natural variation of the magnetic needle, and as being different in different places, has not been adverted to, but the influence of these circumstances would not, of course, be neglected when they were required to be noticed. Not having any *practical* acquaintance with the subject, we submit these observations with much deference to those who are in this respect qualified to offer an opinion.

NOTES AND NOTICES.

Hail Storm Preventing.—M. Arago has proposed a plan for discharging clouds, in cases of storms, of the electric fluid which they contain, and thus preventing the frequent occurrence of hail storms, which, as is well known, are generally produced by two currents of clouds, charged with positive and negative electricity, crossing each other. It consists in an improvement upon Franklin's experiment of the kite, with which he obtained an electric spark from a cloud, and afterwards Dr. Romas, of Nerac, and Messrs. Lining and Charles, of the United States, produced electric flashes three and four feet in length. M. Arago recommends that a small balloon, properly secured, armed with metallic points, and communicating with the ground by a rope covered with metallic wire, like a harp-string, should be kept permanently floating in the air at a considerable height over the spot which it is wished to preserve from the effects of lightning or hail; and he expects that by such an apparatus as this a cloud might have its electric contents entirely drawn off without any damage being caused, or that at least the intensity of a hail storm would be greatly diminished. The experiment is so simple that it is well worthy of a trial.—*Galignani's Messenger.*

Timber Steamers v. *Iron.*—The following challenge is published in the present month's number of the *Nautical Magazine*:—"Mr. Editor,—Having read another account of iron steam-boats in your journal, I think it right to disabuse the public mind as regards the great speed attributed to those vessels over timber-built ones; and particularly to deny the fact attempted to be foisted upon the public, that the *Rainbow* iron steamer, is the fastest vessel afloat. I have now commanded for three seasons an oak-built steamer, in the Thames, built and equipped in London, of 100 horses' power only (the Rainbow is 180 horses' power); and I hereby challenge the above-named iron vessel, for a run from London to Margate and back, for 200 guineas; indeed I

have had this money now subscribed and in my hands for the last eighteen months, for the purpose of running my vessel against any iron or wooden steamer afloat, whatever may be the power or dimensions. I have challenged the wonderful *Rainbow* repeatedly, but they always gave me a wide berth. 'Tis true they once tried their strength with one of our little clippers, the *Vesper*, of 60 horses' power, and the *Rainbow*, of three times the force, actually beat this little ship three minutes from Blackwall to Gravesend! I trust by your inserting this in your valuable Magazine, that it will put a stop to the further boasting and puffing of the builders and engineers of the iron boats, as I am quite convinced that there are plenty of builders and engineers too, in London, who will equip a good timber-built steamer to beat in speed and be much stronger than any of the new-fangled iron steamers.

"R. LIGHTFOOT,

"Captain of the *Ruby* Gravesend steamer.

"P.S. Should any one take a fancy to match the *Rainbow* or any other steamer against my vessel, I am always to be found at the Albion, Gravesend, and I will pay down 50*l.* deposit for the race."

Use of Geology to Farmers.—One of the most obvious sources of advantage to the farmer from an acquaintance with the distribution of mineral masses, is the facility with which, in many instances, the injurious effects of small springs coming to the surface may be obviated. The theory of the earth's internal drainage is so simple, that every man of common sense would be able to drain his lands upon sure principles, or else to know precisely why it cannot be drained, if he were to become so much of a geologist as to learn what rocks existed under his land, at what depth, and in what positions. Springs never issue from stratified masses, except from reservoirs somehow produced in jointed rocks, and at the level of the overflow of these subterraneous cavities. Faults in the strata very frequently limit these reservoirs, and determine the points of efflux of the water. Let those faults be ascertained, or the edge of the jointed rock be found, the cure of the evil is immediate. But some geological information is needed here; and landed proprietors, who think it less troublesome to employ an agent than to direct such a simple operation, may at least profit by this hint, and choose an agent who knows something of the rocks he is to drain. Another thing, probably of importance to agriculturists, is the discovery of substances at small depths, which, if brought to the surface, would enrich, by a suitable mixture, the soil of their fields. This is very strongly insisted on by Sir H. Davy in his essays, and considering how easy a thing it is for a landowner to ascertain positively the series of strata in his estate, it is somewhat marvellous that so few cases can be quoted, except that of Sir John Johnstone, Bart., of Hackness, near Scarborough, in which this easy work has been performed. Finally, in experiments for the introduction of new systems and modes of management, with respect to cattle and crops, it will be of great consequence to take notice of the qualities of the soil, substrata, and water, for these undoubtedly exercise a real and perhaps decisive influence over the result.—*Mining Review.*

Steam Boat Disasters in America.—New York, March 2.—The following is a list of the steam-boat disasters which occurred on the western rivers during the year 1838:—37 steamers snagged, 14 blown up and collapsed, and 29 more or less injured; total 80 steam-vessels. Of the above, 34 were total losses, besides four that could not be repaired. Of the 37 snagged, but four were on the Ohio; and of the whole number, 50 were on the lower Mississippi.

Arsenic.—M. Orfila has discovered a method of detecting the smallest atoms of arsenic, even when administered in solution. For this he used a lamp, the hydrogen gas of which was produced by a piece of zinc, steeped in diluted sulphuric acid. The arsenic, however small the quantity, when exposed to the flame of this gas, is carried along by it, and if a cold substance be presented to the end of the narrow tube conveying the flame, the arsenic will be deposited on it like a spot.

The Society of British Artists announces a series of conversaziones to be held on alternate Saturday evenings, commencing April 6th, to which strangers are to be admitted on payment. The plan includes not merely the exhibition of the pictures, but also the delivery of lectures on artistic subjects: and if well carried into effect, is worthy the consideration and patronage of all who do more than talk about art.

Light Painting.—The announcement of Daguerre's discovery has turned the brains of half the world: you sober English have certainly not escaped the infection; and the speculating Germans, as you have noticed, are hard at it. I learn, by letters just received from Munich, that Profs. Steinhel and Robel are astonishing the natives with their Photogenic pictures. It is *said* that they have discovered the process of M. Daguerre, but it seems to me more than probable that their process rather resembles that of Mr. Talbot; and that by their invention pictures can be obtained not only with the aid of the camera obscura, but by the direct agency of light, so that they take, in an instant, copies of pictures traced upon blackened glass. [No doubt the process here indistinctly referred to is the same as, or similar to, that of Mr. Havell.] Daguerre's pictures are, it is known, traced upon copper [?], but Messrs. Steinhel and Robel imprint theirs upon paper. Several experiments are stated to have been made in presence of a crowd of spectators, and to have been in every instance successful.—*Ath.*

City Greenhouses.—A plan has lately been discovered for keeping green plants in a fresh and lively growing state, in all seasons and climates, with a very small degree of trouble. It is, I suppose, generally understood that greenhouse plants, among which may be numbered many flowering tender herbs, will not grow in the open air in a town, or even in a carefully kept room. Besides being deprived of pure air, the plants are not properly and regularly watered. Watering only now and then does not suit all kinds of plants; many require to live in an atmosphere from which moisture can be at all times drawn. The new and improved method consists simply in the use of a glass case for the plants. The case may be the size of a room, or of a box—it is all one. The top and sides of the case are of glass frames; the bottom contains earth in which the plants grow; the whole is kept closed, except at short intervals, when a small door is is opened for any necessary purpose. The case may be placed in a room at a window full in the sun's light, or if the enclosure be large, like a greenhouse, it may be situated out of doors. The plants being set in the usual manner, the earth is saturated to a certain extent with water, and the case closed. Nature now takes upon itself the entire management of the process. When the sun shines on the case, the moisture rises in a natural evaporation from the earth, and hngs in condensed globules on the inside of the glass. When the cold of evening ensues, the moisture descends, and is absorbed by the plants and by the earth. Thus alternately rising and descending, the moisture in the case keeps up a proper and regular system of irrigation, wherebythe plants are sustained in a state of great freshness and beauty.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 6, Peterborough-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 819.] SATURDAY, APRIL, 20, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

BURSILL'S MINER'S CONDENSED-AIR LAMP AND BREATHING APPARATUS.

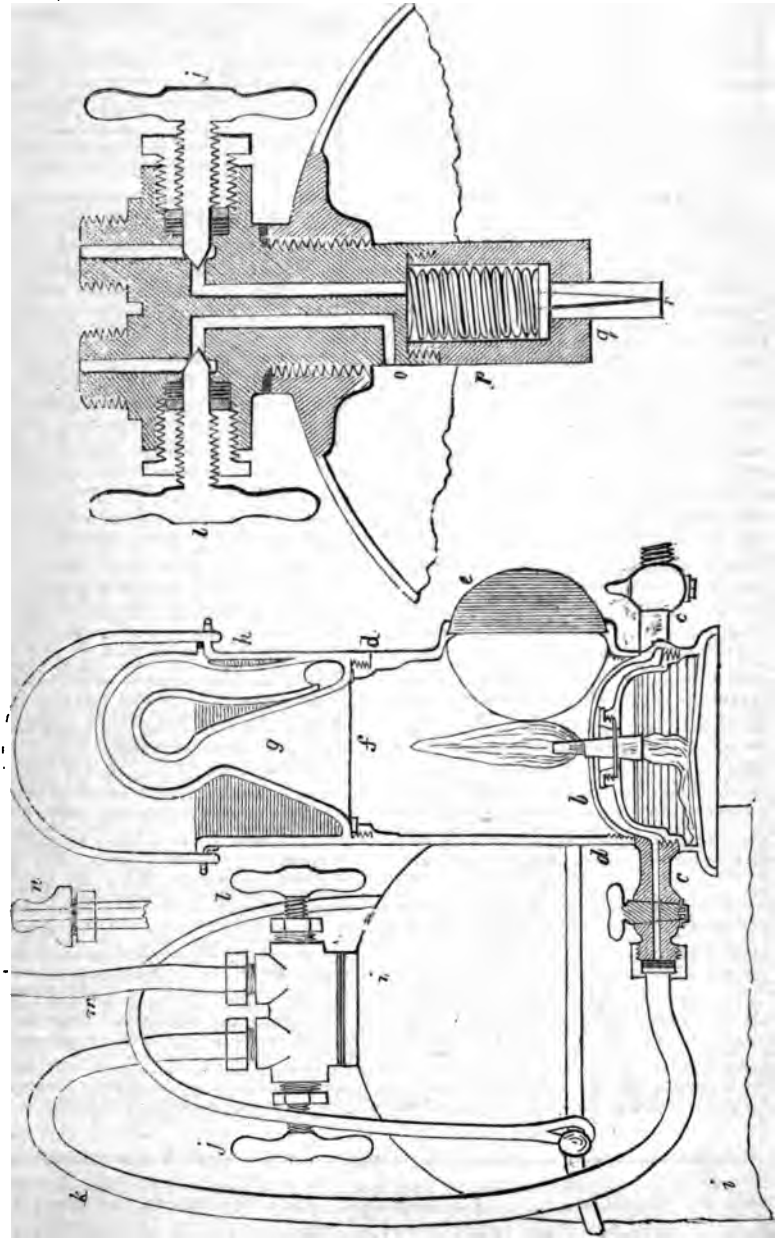


Fig. 2.

Fig. 1.

BURSILL'S MINER'S CONDENSED-AIR LAMP AND BREATHING APPARATUS.

The Society of Arts lately awarded a a silver medal to Messrs. G. and W. Bursill, of Islington, for an improved safety-lamp, which has about it some novel and ingenious features. The principal objections to the invention are its complexity and weight, which we fear will be found so insurmountable as to prevent its use in the working of mines, although it would doubtless, be found useful for explorations. We extract the following description from the last part of the Society's *Transactions*.

"The object of this invention is to apply condensed atmospheric air to the double purpose of supplying the lamps of miners, and of affording to the miners themselves, in particular emergencies, pure atmospheric air for breathing, while exploring those parts of a coal mine that may happen to be rendered hazardous to life, from the quantity of carbonic acid and other unrespirable gases that they may contain.

"This lamp is completely insulated from the mine, the flame being enclosed in air-tight fittings, and its combustion being supported by fresh atmospheric air condensed into close vessels, and then brought down into the mine. The foul air from the lamp is expelled into the mine in a perfectly secure manner; for though it can no longer support combustion, and has nothing in its nature that can communicate light to the external air; yet it is doubly guarded; first, by passing through wire gauze, and then having to bubble through water. Thus the bare possibility of a spark from the flame passing the chimney, is totally prevented.

"Fig. 1 represents the lamp, with the reservoir and the tube which connects them together. *a* is the oil vessel of the lamp, over which is screwed the cap or dome *b*, having a central aperture, in the middle of which the burner or wick holder just rises through: in the opposite sides of this cap are fixed the two cocks, *c c*. The body of the lamp *d d*, with a lens *e* in its side, is screwed into the cap *b*. On the top of this are laid two or three plates of wire gauze, *f*, over which is screwed the chimney *g*; the end of this chimney is bent downward, and is surrounded by a vessel *h*, to contain water, into which the end dips. *i i* is part of a vessel made sufficiently strong to hold condensed atmospheric air; this it gradually imparts to the lamp through the screw cock *j*, flexible tube *h*, and cock *c*, from which it passes under the cap *b* to its central opening, where it enters the lamp close around the flame. *l* is another screw cock from the air vessel, with a flexible tube *m*, the end of which is furnished with a mouth-piece *n*, from which the workman, in case of emergency, can obtain a breath of fresh air.

"In order to supply the lamp uniformly with air, it is made to pass through a very small opening at first when highly condensed, and this aperture gradually enlarges as the pressure lessens.

"Fig. 2 is a section of the screw cocks *j b*, to show their peculiar construction. The screws *j* and *l* have cylindrical portions passing through collars of leather to keep them air tight; their conical points shut or open their respective apertures. The cock *l* opens directly into the vessel *i* through the aperture *o*. The cock *j* is the one from which the lamp is supplied, it therefore has a self-regulating aperture attached to it. The aperture of the cock enters the chamber *p*, made large enough to contain a spiral spring; at the bottom is another opening *q*, into which is nicely fitted the cylindrical plug *r*, as air tight as possible consistently with sliding freely; on the top of this is a disk, on which the spiral spring that fills the chamber *p* acts to thrust out the plug *r*. In the side of this plug is made a groove, as shown in the figure, very small at the lower end, and as much larger at the upper end as the lessening pressure will require to let the air escape at an equal rate from first to last.

"The strength of the spiral spring, and diameter of the plug *r*, are made to correspond with the intended condensation of the air. Whilst the cock *j* is shut, the spring can keep the plug *r* down, as here shown; but as soon as the cock is opened, the difference of pressure between the external and internal air, pushes up the plug *r*, notwithstanding the resistance of the spring, leaving only the smallest part of the groove exposed for the air to escape through; but as the pressure lessens by escape of the air, the spring becomes able to protrude more of the plug *r*, and thus present a large portion of the aperture, through which a larger portion of air may pass:

is a tolerably equal supply of air will given from first to last.

When the vessel *i* is nearly exhausted, other vessel is connected with the ier cock *c*, fig. 1, ready to be let on ore the other is taken away."

THE LONDON FIRE BRIGADE.

h! what shall we do?" the bold Fire King said,
As he sat where the 'Change should have been,
hey've attack'd our good friends of the London Brigade,
"Was ever such impudence seen?"

en up spoke a vassal, a vet'ran at court,
"A way out of limbo I spy,
Our champion shall swear his old Fire Report
"From beginning to end was a ——." "*Fie!*"

h, fie!" cried the chief, in a voice far from sweet,
Though his eye sparkled bright at the fun,—
f to make out a case his own words he must eat,
"The job will be *Baddeley* done!"

Sir,—Curtius himself could not have d a stronger feeling for the weal of me than your worthy correspondent . Baddeley, for the reputation of the e Brigade. Rather than the slightest credit should rest upon their efforts, is willing not merely to admit, but to ert, that the Reports on London es, which he furnished to the *Mechanics' Magazine*, previous to the establishment of the brigade, are — (how ill I phrase it?)—*not to be depended on*. A stronger instance of what may y properly be called *self-denial*, could easily be imagined. If any one else l ventured on such a charge, Mr. ddeley might well have expected hold himself an insulted individual; t what is to be said when the accused l the accuser meet in one and the self- ne person? If we would avoid inuating that Mr. B. made one very orrect assertion last week, we must force allow that he made *a great ny* some time ago! From this dima there is no escape.

But even admitting all that Mr. Badey himself can wish for as to the unnded nature of his own reports for gone years, there is enough in the t one alone to overthrow the whole assertion as to the "increased comative security of lives and property" der the new system. What are we think, for instance, of the inconsistcy, which he has not attempted to exin away, *of filling up an article containing "such a list of total losses as* has seldom before occurred," with enthusiastic praises of the successful exertions of the brigade? Ever since the establishment of that body, Mr. Baddeley has been most abundantly supplied with materials for his reports; great and disastrous fires have, as every one knows, abounded to an unprecedented extent; and yet Mr. B. has never been weary of congratulating them on the "success" of their exertions. This seemed rather an inconsistent process, until Mr. B.'s letter appeared, taunting the Parisian firemen with their want of success in having had only one great public building burnt down in a whole series of years. This letter seemed to throw great light on Mr. B.'s notions of the duties of firemen, and to clear up the mystery as to his formerly incomprehensible trumpetings of the fire-brigade, in the same breath with long and terrific details of the progess of unchecked calamity. Mr. Baddeley, indeed, objects to this application of his views, but as he does not condescend to say why, I need not take the trouble to guess: he may depend upon it that the position he took up in reply to Mr. Simeon is the best one after all: if the extent of damage done under their "protection" be taken as the touchstone of success, the brigade will be pretty certain to come off triumphant.

The present occasion is not the first in which Mr. Baddeley has "turned his back upon himself" when the subject of fire insurance was in question. Time was that he held, and held most firmly, the opinion that no highly-efficient system of fire-police could be expected while the matter was left entirely in the hands of the insurance companies. Now, the perfection of the brigade system, and its "high efficiency," are his never-ending themes; many are the contradictions given him, not only by his repudiated reports, but by facts that would have stared us in the face just the same as if his reports had never seen the light. How is it that this "change" has "come o'er the spirit of his dream?" Whatever the cause, certain it is that his opinions on this point have been completely revolutionized since the praises of Braidwood and his brigade have become his constant care. He may coolly assure us, perhaps, that the opinions advanced in his unfortunate re-

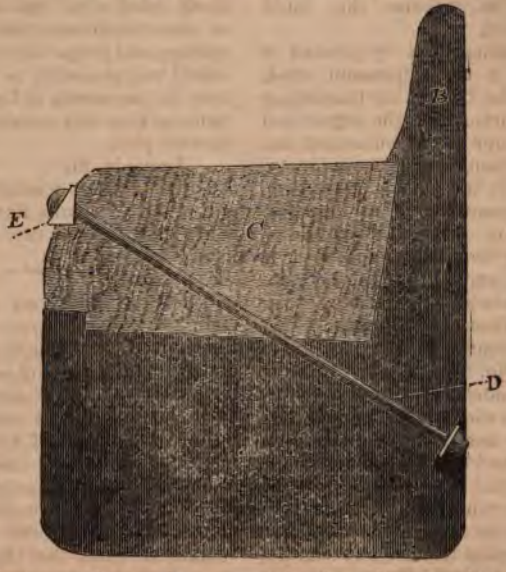
ports are as little worth notice as, he now tells us, were the (presumed) facts they contained. A great deal may be conceded to so candid a gentleman, but not so much as this, when the proposition to be thrown overboard is one so almost self-evidently true as this; that *it is not to the interest of the insurance companies to establish a fire-preventive system of the "highest degree" of efficiency.*

Upon this pivot really turns the whole of the discussion between myself and Mr. Baddeley;—the Mr. Baddeley of today, that is, for the Mr. Baddeley of yesterday not only asserted, but stoutly maintained the same identical proposition. The chief aim of the fire-offices in everything connected with the brigade, is evidently to make as great a show as possible at the lowest possible cost; and in this they are well seconded by Mr. Baddeley, who appears delighted with every matter of mere display, from the fancy-ball dresses of the men, to the gin-shop fronts of the newest stations, in which economy is judiciously combined with parade. At the same time, anxiety to ensure the real efficiency of the fire establishment is much less distinctly visible, as is evidenced at once by the fact, that the immense masses of property in the metropolis, and the million and a half of lives of its human inhabitants, are left to the protection, so far as the insurance companies are concerned, of *somewhat less than one hundred* men, and those both for day and night duty. Can it be wondered at that "serious and fatal fires have increased in at least as great a ratio as the expenses of the insurance offices have diminished?" Or is it at all amazing that the efforts of such a mere handful of men should have been attended with *that sort* of "success" which Mr. Baddeley thinks it their duty to aim at? If it be so to other constant readers of his annual fire reports, it is not by any means to

Mr. Editor,
Yours very respectfully,
AQUARIUS.

London, April 9, 1839.

ANTI-NOISE CONTRIVANCES, &c., FOR RAILROADS AND PUBLIC CARRIAGES.



Sir,—About four months ago I troubled you with a plan for the better security of railway travelling; I now submit (what is perhaps nearly as much the interest of companies to study) a mean of *lessening a nuisance much complain*

of, viz., the hoarse ringing noise which must always be occasioned by iron rolling upon iron.

The figure represents a section of the circumference of a carriage wheel. A is the cast-iron rim; B its flanch; C the tire, composed of blocks of tough close-grained wood, cut across the grain; the grain being set nearly but not quite upright upon the rim, being inclined a little towards the flanch, as shown by the shading. This wooden tire is secured by bolts D passing through a metallic ring (shown in section at E) which accompanies the whole circle of the tire, and is concentric with it. The blocks are also held in their place by a projecting rim cast upon the flanch. The engine-wheels must, of course, have iron tires to obtain the bite for propulsion, but the adoption of such a plan for carriage and waggon wheels would remove a fruitful source of complaint, not only from passengers, but (I speak feelingly) from inhabitants of railroad districts. Another advantage would be diminished concussion, and consequently wear, to the carriages. Experiment would soon decide whether wood can endure the pressure, and this probably without much expense. If the blocks were cut by machinery to one size, they could easily be renewed.

Another nuisance felt by persons of quick nerves, is the unpleasant smell arising from the heated oil lubricating the rubbing surfaces of the engine and carriages. In our age of refinement and discovery can chemistry devise no remedy for this? It might be worth a little additional expense, for every improvement tending to remove a prejudice against railway travelling must benefit the companies, and the public generally are, perhaps, even more solicitous of personal comfort than of safety.

In my late communication on public conveyances (No. 813, p. 413, I omitted to propose a mode of preventing the rattling of omnibus windows. These generally slide loosely up and down in grooves cut in the frames, and though thumb-screws have been applied to fix them, their vibration greatly counteracts this remedy, not to mention the trouble of such a proceeding. I propose that a short iron pin should project horizontally on each side from the *top and bottom of the sash*, in the *same plane with the glass*; these pins to fit accurately between brass guides let flush into the frames, no other groove being required. Thus, let the sashes vibrate as they will, they have nothing to rattle against. It is possible, however, that windows on this plan might not be so good a protection against the weather.

Many of your readers will have observed the recent appearance in London streets of an omnibus resembling two round-houses united by a platform below, on which the conductor stands, and two bars above, this twin body being hung within about a foot of the ground. It seems that both pairs of wheels lock round the bodies, a circular form being therefore given to the floors, and that the axles are connected by rods beneath. The patentee (for I believe he is thus protected) has probably not been happy in his builder, for, though no doubt safe enough, it is clumsy and uninviting in appearance. It has surprised me that, in the present rage for novelty in public conveyances, no effort should have been made to introduce Adams's equirotal omnibus, which has the merit of simplicity of construction, and seems to possess great capabilities for lightness of draught, safety, and accommodation. One of these, fitted with "antisonant" windows of whatever construction, the patent bow springs, and straps instead of pole-chains, would roll as silently as any vehicle can over the pavements of London; probably more so than any private carriage on the present plan.

I remain, Sir,
Yours obediently,
JOHN RIVINGTON, jun.

Sydenham, March 25, 1839.

ON THE LIMITS OF RAILWAY VELOCITY.

Sir,—Notwithstanding all that has been said on the subject by your correspondents and others, I think that Dr. Lardner is well aware of the real cause of the limit of railway speed, and that he purposely conceals the true cause, for the purpose of giving yourself and really clever correspondent, Mr. Chiverton, a little brain exercise. What makes me think that the Doctor is possessed of the secret is, that he asserts that the friction decreases as the speed increases, and that together with the

increased resistance of the atmosphere is the true cause of the limit of speed.

Now by way of solving the Doctor's riddle, I will put the following query to your mathematical correspondents.

If the line of direction of a body in motion be a tangent to the line of gravitation, would it not follow that the gravity of a body is decreased, as the velocity is increased, and that the gravity would be lost, when the velocity of the body in a tangential line, is equal to the velocity with which it would gravitate?

Is not this, together with the resistance of the atmosphere, the cause of the limit of the speed of a locomotive engine on a railway? Does not the friction (or I would rather say the adhesion) that is between the wheels of the engine and the surface of the rail, decrease as the speed of the engine is increased, and that at a certain velocity it is nothing?

It is impossible that speed equal to gravitation can be obtained on a railway, therefore there will always be adhesion between the wheels and the railway equal to propelling the machine with a certain velocity, and that velocity will be entirely dependant on the resistance of the atmosphere.

I do not know whether I have made myself understood, or not, by the foregoing, but in plain words, this is what I mean. That at a certain rate of speed the weight of the engine is so little on the rails, that however fast the wheels may revolve they cannot propel the machine forward. For suppose the machine suspended to a balloon, so that the wheels would but touch the rails, I think it would be absurd to expect that the machine would be propelled forward by making a smooth wheel revolve on its own axis.

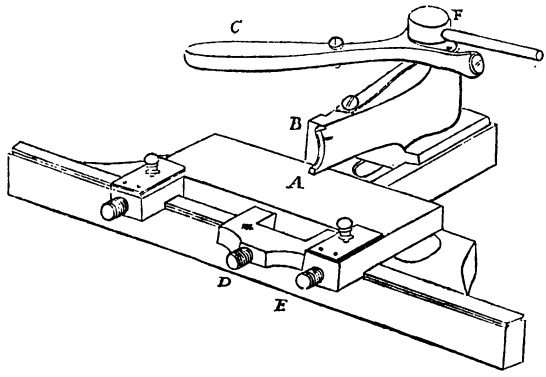
If we cannot be content with speed about 33 or 34 miles an hour, the only mode that I can see of increasing the speed, is, when it has arrived at its maximum by the usual means, let there be a propeller to act against the atmosphere, in the shape of a screw, the axis of which is in the line of the direction of the machine.

I hope I may be pardoned for suggesting a practical mode of ascertaining the quantity of projecting force to be equal to the force of gravitation. Let a portion of the railway be made on the principle of the weighing machine with an index that will remain fixed after the weight is taken off; then let a known weight at different velocities be passed over it.

I am, Sir,
Yours respectfully,
B. H.

Fountain Hall, 29th March, 1839.

HOLTZAPFFEL'S MONOTYPE PRESS.



Sir,—Some time ago I contrived a monotype press for labels, or short descriptions, of which, from their nature, but one single copy is required, as f specimens of natural history, works art, &c., which commonly differ in

most every respect, either as to character, structure, or locality.

The principal inducement to taking the trouble of arranging types in a chase, as in ordinary printing, namely, the facility of afterwards multiplying copies, does not exist in this case, and in consequence the labour of printing would be rarely undertaken.

By the arrangement of the monotype press, however, the trouble of the process is, on the whole, much diminished, as the types, or letters, are only picked out of trays one at a time, and printed from separately, by means of a blackened paper, and then immediately returned to their places in the tray, and that with considerable facility of manipulation.

As in common printing, the perfection of the result is mainly dependant upon the accurate structure and uniformity of the type.

The monotype press consists of a small casting, in iron, with a little sliding table A, which is guided in a straight line by the ledge, or rib, on the principal piece, and is fixed thereto by the little binding screws EE (one only being lettered), the card or paper to be printed upon, with a piece of the prepared blackened paper laid above it, is attached to the table A, by means of the little clamps and screws upon the surface of the table.

Suppose it is desired to print the word ASBESTOS, the letter A is held in the notch at the end of the arm B, with the thumb and forefinger of the left hand, with its face downwards, and the nick of the type outwards, or towards the operator, and it is then pressed down by means of the lever C, with the right hand. (The small screw in the lever is adjusted once for all to touch the arm A, so as to prevent the smaller letters and stops from being pressed so hard upon the paper as to indent the surface.) When this letter has been printed, it is necessary to move the table and paper to the left hand, as otherwise the following letter of the word would be impressed upon the preceding one.

The quantity the table must be shifted will be given by the shaft of the type itself, as the widths of each shaft have been fixed by the type-founder, so as to be exactly *proportioned to the size of the respective letters; thus the type* for the succeeding letter of the word ASBESTOS, namely, S is placed *with the nick upwards*, between the arm E of the table, and the loose stop D; (in fact the type is as it were pinched between them, in the direction of its width), and the stop is then fixed, the table A is loosened and re-fixed, in *contact* with D, it will then have been shifted, exactly the space needful for the letter S; and lastly, the the letter S is impressed on the paper: that type having been returned to the tray, the same routine is gone through with the succeeding letter B, namely, the stop is shifted exactly the width of the B, and the table is run up to its new position, and the third letter of the word is impressed; after a little practice, this will be found by no means a slow operation.

It should have been observed, that one of the screws E (not lettered) is purposely left stiff; it is adjusted to allow the table to slide freely without shake, and is not afterwards disturbed; some prefer holding the type in the nick B with the thumb only, placing the forefinger at the back of the sliding arm.

In common printing, *spaces* and *quadrats*, or blank letters, are placed between each word, for their separation; it is best to take up the quadrat and the first letter of the following word *together*, otherwise two adjustments of the table would be necessary. To separate the letters thus, the types and the particular space should be used together, as above.

One line having been completed, the apparatus is shifted for a new line by releasing the screw F, and advancing the arm B. To save the expense of a stop similar to D for that purpose, and in fact as the most convenient arrangement, the face of the instrument is graduated; three of the divisions will be found equal to the height of the small type, called Pica, and four to that of the large, or Great Primer, but 5, 6, 7, or 8, or any other number of divisions may be used, for giving more space between the lines, which would be effected in ordinary printing by inserting leads between the lines of type.

As the fount of type required for the monotype press is only a single letter of each kind, the variety of sorts may be extended without a great increase of ex-

pense; six alphabets are enough in ordinary cases, and a duplicate set of each may be added in case of accident; making a total of 472 types.

The blackened paper, called also camp paper, is prepared for writing with, by means of a style, or blunt point. It may be made by grinding together lamp black and any unctuous substance that will not dry, as neat's-foot oil, sperm oil, lard, soap, &c.; the first seems to answer best. The pigment is laid on the one side of thin hard paper with a sponge or brush, is allowed to remain on for a few hours, and the greater part is then rubbed off. Colours may be employed instead of lamp black.

In printing upon paper, it is necessary to put two or three thicknesses of waste paper, or card, beneath, to serve the purpose of the blanket in the common press; card does not require any thing beneath it. Two, or even three, impressions may be made at once, by placing alternately the white and the prepared papers: two copies succeed very fairly, especially when the lower is on card, and, of course, the thinner the papers, the greater will be the success.

C. HOLTZAPFFEL.

64, Charing Cross, 28th February, 1839.

PORTABLE PRINTING PRESS.

Sir,—Several portable printing-presses have at different times been described in your pages, and I beg leave to add, another to the list, which, for small purposes, I believe to be fully as effective as any of them, and decidedly more simple in its construction. I have found a press of this description exceedingly useful upon many occasions. It is composed of two slabs of beech wood, ten inches long by six inches wide, jointed together at one end by a pair of cast-iron hinges. The under slab or *press-bed* A is one inch and a half thick: the upper one, or *platten* B is one inch in thickness. A well, or space for holding type is cut out at C, the depth being about three-fourths the height of the type. A strong iron strap passes along the under side of the press-bed, and rising at the end D is connected with the lever E by *a common* rule-joint. On the top of *platten, there is a piece of* half-round iron, to receive the direct force of the lever and distribute the pressure evenly over the surface of the type; *f* is the frisket jointed to the platten.

The *form*, such as an address-card, a book-label, price-ticket, or other matter, being set up, is to be placed in the centre of the well C, and wedged up tight. The paper, &c. is placed on the platten, and the frisket folded upon it, after which the platten is turned over on to the type, previously inked. The handle of the lever is brought over the press and forced down with the right hand—the left resting on the opposite end of the press to prevent tipping up. The The distances between the fulcrum of the lever E and the point of resistance, *i. e.*, the top of the half round iron bar: and between the latter point and the handle, are such as to increase the power nearly ten fold. By this means a sufficient pressure is easily obtained for producing a beautifully clear and distinct impression. By dint of a little management with the frisket the *register* is preserved with great accuracy, so much so, that I have executed jobs with this apparatus, which professed printers have been unable to accomplish with their superior machines. A piece of flannel is affixed to the platten to bring up the characters on the paper. A dabber of leather, stuffed with wool or cotton, will do very well for inking, but I employ a composition (glue and treacle) roller.

Being simple in construction, a press of this kind is easily made, while its parts are so few, and those few so substantial, that its durability is equal to its simplicity.

To shopkeepers, for stamping their imprint on wrapping papers, for adding their name and address to lists of articles sold, for price tickets, book labels, &c., this apparatus is peculiarly useful; while it occasionally happens that its powers may be very conveniently employed upon even higher objects, with advantage.

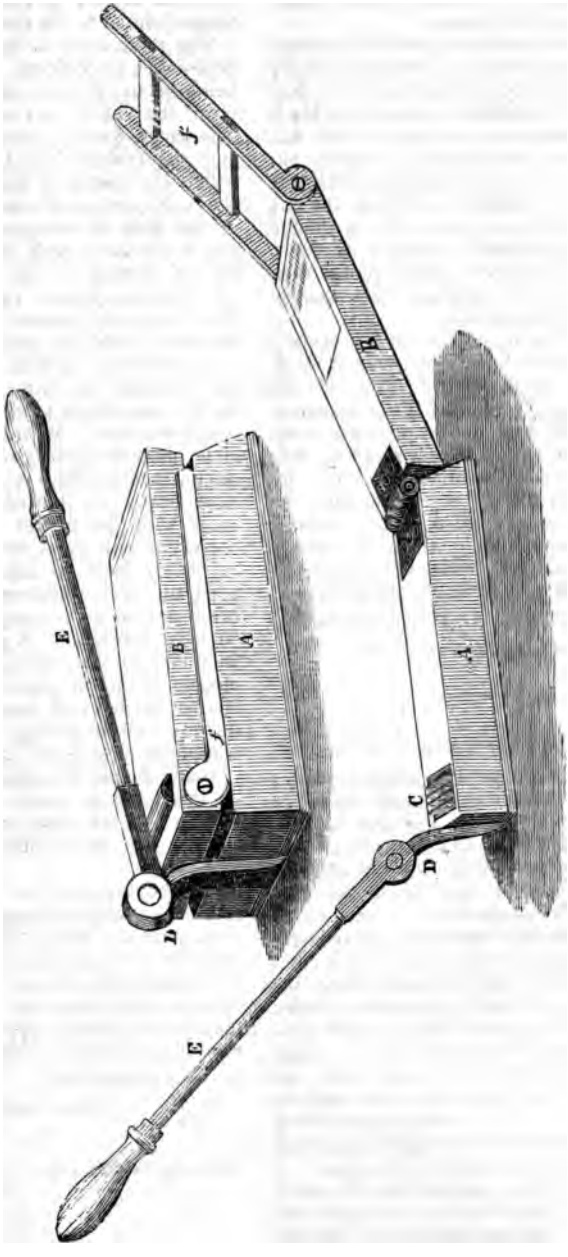
I remain, Sir,

Yours respectfully,

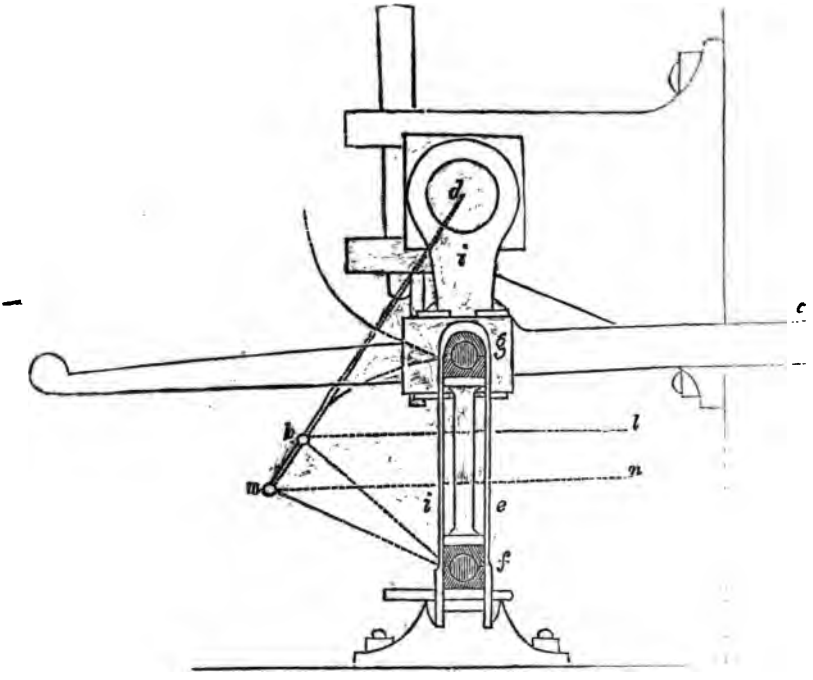
WM. BADDELEY.

London, March 20, 1839.

BADDELEY'S PORTABLE PRINTING PRESS.



METHOD OF WORKING THE VALVES OF A STEAM-ENGINE, WHICH COMBINES THE SIMPLICITY OF THE ECCENTRIC MOTION, WITH THE ADVANTAGES OF THE HAND GEAR ENGINE—BY MR. JAMES WHITELAW.



Sir,—The accompanying figure, which is a side elevation, shows my plan of working the valves of a steam-engine. *c* is the eccentric rod, and *d* the rocking shaft; these parts are the same as in other steam-engines. The links *e*, (there is one on each side) form a connection with the fixed centre *f*, and the pins *g*, which are of one piece with the pin upon which the gab of the eccentric rod gears. The lever *ii* is forked, and a part of it is planed, in order that the pin upon which the gab of the eccentric rod gears, may be shifted out or in on it, by the motions of the links *e*. The construction of the lever *ii*, as well as of the parts in connection with the pins *g*, and the pin upon which the gab of the rod *c*, gears, will be understood from an inspection of the figure.

When the pin upon which the gab of the eccentric rod gears, is near to the centre of the rocking shaft, the valves will have a quicker motion than they would have if this pin were fixed on the lever *ii*, at a greater distance from the centre of said shaft. Now it is my idea to have the pin upon which the gab of the rod *c* gears, near to the centre of the rocking shaft, when the piston is not far from the beginning or end of its stroke, and by this means get advantage of the quick motion when it is most needed; and keep shifting it quicker towards the out end of the lever *ii* as the piston comes near to the middle of its stroke, so as to have the motion of the valves slow when they are about open; and also to give the valves a stroke just sufficient to open them full. Large valves are found to be of great use for forming the vacuum quickly, and on the plan here described, and with much smaller valves, the same advantage will be obtained; for when very large eduction valves are used, the vacuum is about perfect, long before they are full open.

The valves of the engine being shut when the parts have positions, as per the figure; it will be evident that the links

e, have the best possible position for keeping the pin upon which the gab of the rod *c*, gears, near to the rocking shaft, all the time it is desirable to have the motion of the valves quick; and these links are also correctly placed for working the valves slow at the proper part of the stroke of the engine.

Large valves are very expensive to make; they take great power to work them; it is often difficult to find room enough for them in steam-boat engines; besides they are difficult to manage, especially at the stopping, starting, or reversing of the engine when it is a powerful one; and much smaller valves, if fitted up as here described, will have none of these disadvantages. The plan described in this letter has another advantage, it is this; that any engine working on the old plan can readily be altered to it.

I am, Sir, ever truly yours,

JAMES WHITELAW.

Glasgow, March 18, 1839.

WHAT HAS BECOME OF THE "BRITISH QUEEN?"

Sir,—Allow me to inquire when the "British Queen" steam-vessel, launched 12 months since in this our Port of London, may be expected home from her cruise after steam-engines, I believe, either on the broad Atlantic, or somewhere near the coast of Scotland?—Verily, I don't know which to admire most—the ingenuity of our northern engineers, or the sagacity of my cockney neighbours! Here we have a magnificent vessel dragged from the Thames to Glasgow, at great risk and expense, in search of engines, and there detained a whole year!—while dozens of Scotch steamers are lying for sale in the City canal, and would be thought dear at half their prime cost! In fact, all the world, except the sapient gentlemen connected with the "British Queen" are perfectly aware that London-made steam-engines (like most London-made goods), are decidedly the best, whether efficiency of power, solidity of workmanship, economy of room or of fuel, or punctuality and dispatch of the manufacturers be considered. The Bristol people (said to sleep with both eyes open), aware of these circumstances, sent their "Great Western" to us, and she was most efficiently *fitted*, in less than four months, by Messrs. Maudsley and Co. with engines, which have carried her already a distance equal to twice the circumference of "the great globe itself!" Messrs. Seaward and Co. fixed the magnificent engines of the "Gorgon" Frigate, in two months from the time she arrived at their wharf at Millwall; and a finer specimen of naval architecture or engineering, or a more efficient sea-boat I think, I may boldly assert, cannot be found anywhere! The "Nicholai," a superb Russian steamer, which the public are now invited to inspect in the City canal, was absolutely built from the keel, fitted with engines by the same firm, and got ready for sea, in less than six months!

It is now rumoured that the "President" (the sister vessel to the "British Queen,") is also to go seeking for her engines somewhere in the north. Thus, even after such dear bought experience, are vessels, built here, and requiring every advantage of efficiency and dispatch, to retain a chance of fair competition, sent—perversely sent away from the place, where alone they can properly and speedily be supplied,—and where they naturally ought to be furnished with their steam power, and then we wonder that steam companies do not succeed!

Our good friends, the Scotch, proverbially know how to pass off certain inferior birds "*as swans*," but it would have required something like their "*second sight*" to predict, at the time the "British Queen" and "President" were first projected, that the London shareholders were "*goose enough*" to be so "gulled!"

An answer to my inquiry will, however, under all circumstances oblige,

Sir,

Your most obedient servant,

BOW BELLS.

Cheapside, April 13, 1839.

ON MECHANICAL PROBABILITIES!

My dear friend, and fellow-labourer,—It may so happen that I am not the only solitary "peculiarity" amongst your hard-working and ever-thinking readers, who, when the bow has been too long strung, occasionally indulges for a moment or so in indolent ease, musing or dreaming "de rebus omnibus, et quí-

busdam aliis," which means, *about things in general, and some few others;* but should I be the one and only exception, the results will be the more uncommon, and may not perhaps be less instructive than the lucubrations which now and then emanate from folks who dream while they fancy they are awake.

With a north-easterly wind attacking through every crevice of the door and windows, and energetically striving to blow out a blazing fire which bade it defiance, I placed myself as mediator between the combatants, and with a leg on either hob of parlour grate, received the violence of the one enemy "*à posteriori,*" and faced the more congenial element. I soon felt too happy! and musing over mechanism and mechanics, I thought of Babbage's "calculating machine," and then of the embryo "talking instrument," and felt that a space in mechanics was yet but imperfectly explored, which, if cultivated, might perchance prove of essential benefit to mankind. Perhaps here I slept, and dreamed,—for having conceived our religious doctrines to be of an immutable nature, and that almost every text in our sacred Scriptures had received the fullest expositions of our ablest divines over and over again; and that little more could be advanced which had not been promulgated by voluminous edited publications, I fancied every pulpit had become a *steam-engine* of very "small power," every clergyman a "*talking instrument,*" and every sermon a "*barrel*" "pricked" for its text. I thought of the saving to the agriculturists in tithes, and to the more important public in dues, fees, and other taxation,—and again felt too happy!

I then dreamed of schools for public instruction, in which the master's desk was the *steam-engine*, the master the "*barrel*" "pricked" either for grammar (English, Latin, or Greek), or for mathematics (pure or mixed). I fancied the usher the engine-man, consuming his rod in "teasing" the fire, while the boys stood around Babbage's machine with their slates in hand, listening to the explanations from the *talking barrel.* I fancied I saw *barrels* representing Professors of Oxford and of Cambridge, "shifting" according to expediency, some *branded* "*multum in parvo,*" intended *for the elucidation of four or five* branches of Natural Philosophy, in lieu of so many professors. I next fancied I witnessed *barrels* for debating societies. I imagined the "Westminster Medical Society" blowing the dust off its *barrel* for discussing "*malaria,*" and shifting the same for the discussion on the "*effects of carbonic acid gas.*"*

N.B.—This *barrel* appeared to be of antique manufacture, and required renovating "*secundum artem.*" The members seemed to despise both a *Cooper,* and a *Brande* mark; for a certain Cooper in attempting to Brande a Malthusian novelty got "stove in," at which the cruel members re-Joyced and dethroned a Harper for their amusement. Methought I saw some of their *barrels* turning into *Butts;* but as it was *Snowing* fast, I might have been mistaken.) Here, I suppose, I was wandering at too great a rate, for feeling my boots growing warm, I roused myself and went to my usual occupations lest my next errand should be *bootless.*

Believe me yours very truly,

CHAS. THORNTON COATHUPE.

Wraxall, near Bristol, April 9, 1839.

EXPERIMENTAL SUBTERRANEOUS AND SUBAQUEOUS EXPLOSIONS AT CHATHAM BY THE VOLTAIC BATTERY.

[From a Correspondent.]

For several months past the Royal Engineers at Chatham, under Colonel Pasley, have been trying experiments in firing gunpowder by the voltaic battery, chiefly under water; and, after many vicissitudes of partial success and of failure, they have at last succeeded in bringing this process to as much perfection as it seems capable of—that is, to as much certainty as the former methods of firing mines in dry soil. They have repeatedly fired gunpowder at the distance of 500 feet, with their conducting wires either buried under ground or led entirely under water, excepting a few feet connected with the battery, which in their subaqueous explosions was in a boat on the Medway, the powder being lodged at the bottom of that river. In their subterraneous explosion they blew up a field work, and in one of their subaqueous experiments they blew to pieces a vessel representing a wreck, the fragments of which being of fir timber came up to the surface of the Medway immediately after the column of water thrown

* Vide Lancet for the present year.

up by the explosion. On Saturday last they applied their voltaic battery to the blasting of rock under water. Two very large and heavy pieces of hard sandstone were each prepared with a hole three inches in diameter by a borer, after which a charge of three quarters of a pound of powder was put into each, and the upper part of the hole was tamped by pouring in small fragments of broken stone round a cone fixed over each charge, in a new and ingenious manner, first suggested by Mr. Howe, clerk of the works of the Royal Engineer Establishment, more than five years ago, which does not seem inferior in resistance to the common mode of tamping, but is much safer and far more expeditious. The conducting wires were led from each charge to the battery, which was placed on the gun-wharf, whilst the stones thus prepared and loaded were lowered down from a crane to the bottom of the river opposite, where the water was fourteen feet deep at the time. The first stone, being of a compact form, was blown to pieces, and the rope sling by which it had been lowered, and which had not been removed, was broken. The second stone, being of a more irregular shape, and much thinner, so that there was not sufficient resistance above and below the charge, was brought up by the crane after the explosion, which had only blown out the solid part of the stone below the bottom of the hole, apparently without injuring any other part of it. Another charge was therefore placed in the same hole, which was tamped both above and below in the mode before described, and the stone was then again let down to the bottom of the river, and after firing this second charge, on being hauled up by the crane it was found to have been broken into three parts, one of which did not reach the surface, whilst the other two, being still held together by the slings, after being raised nearly to the level of the wharf, separated from each other and fell to the bottom. One of these charges was contained in a tin cylinder fitted to the size of the hole, the two others in canvass bags of the same form covered with waterproof composition. These last experiments, which, like several of the former, were witnessed by a great number of spectators, chiefly military, have proved that the voltaic battery may succeed for blasting rock under water, as well as for blowing wrecks to pieces, and in the former supposition the holes in the rock would be formed and the charges placed by means of the diving-bell.

The results of this course of experiments may be of *great importance, especially* for *defensive military mines, because* the voltaic *battery affords the only possible* means of firing several such mines, not only instantaneously but simultaneously, and at the very moment when an enemy's column advancing to the assault is over the spot where these mines have been prepared; whereas by the common mode of firing military mines, by a piece of portfire or slow match connected to a powder hose, there can be no certainty of their taking effect at the precise moment required, so that the enemy's troops might either have passed over, or not yet reached, the spot, at the period of explosion; and the simultaneous explosions of conjunct mines by this method is out of the question, for no two pieces of portfire or powder hoses, though cut to the same length, were ever known to burn exactly alike. For subaqueous explosions the superiority of the voltaic battery is still more striking—so much so, that Colonel Pasley has repeatedly declared, that if he had been possessed of the same voltaic apparatus, and had known how to use it, last year in his operations in the Thames, it would have saved a great deal of trouble and expense.

Nothing can appear easier than to fire gunpowder under water by the voltaic battery, as exhibited in a lecture-room or scientific institution, but the mode usually adopted on such occasions, of passing the conducting wires into the charge through a cork coated with sealing wax, and of insulating the remaining length of each wire by enclosing it in small India rubber tubes, is inadequate and inexpedient for practical purposes in a rapid tideway and in deep water. In Colonel Pasley's experiments at Chatham corks and sealing wax were rejected, the former as being too weak, the latter from being liable to crack, and India rubber or caoutchouc was also rejected, as being far too expensive; instead of which a composition of pitch, softened by bees wax or tallow, was adopted, the remarkable efficiency of which was proved by keeping one of those experimental charges ten days under water before it was fired, when the powder was still perfectly dry. Each pair of conducting wires used in these experiments, was always attached to a rope or line, previously saturated with boiling tar, to prevent it from tearing asunder the soldered joints of the wires, by its alternate contraction and expansion when wet and dry, an effect which on one occasion actually took place before the rope was so saturated. The two wires and rope were bound together by tape and served round with hemp yarn, and in this state they had the appearance of a single rope capable of being coiled and veered out conveniently. One of the most important points necessary was to prevent all strain acting upon the conducting wires from without, and thereb

breaking the very small delicate platinum wire within the charge, which, by interrupting the circuit, would render explosion impossible. To guard against this cause of failure in the shocks to which the conducting wires may be exposed in a rapid tideway appeared at first a very difficult task.

The voltaic battery used was of Professor Daniell's improved construction, which, from retaining its energy much longer than any former voltaic battery, he has named the constant voltaic battery, and which Colonel Pasley found to be much superior to the best of the former constructions, at least for the peculiar purpose of firing gunpowder either under ground or under water. Sergeant-Major Jones, and the non-commissioned officers and privates who have been employed in these experiments, are now as expert in the use of this battery as can be desired, and, being artificers, they are able to make as well as to use such batteries.

Having described these recent interesting experiments of the engineers at Chatham, we may add a brief historical notice of what has been done before. No doubt small charges of gunpowder must have been fired by the voltaic battery, as a matter of experiment and of curiosity, almost as soon as the first rude battery of that description was invented, but the merit of having first applied it to practical purposes is due to Dr. Hare, of Philadelphia, whose proceedings were published some years ago in Silliman's *American Journal of Science* (vol. xxi. page 139), and more recently in a paper communicated to the British Association in 1836, and published in vol. v., in the transactions of the sections for that year, page 45. Dr. Hare states that he used it in blasting rock for the purposes of building, and that he has even fired twelve blasts simultaneously at the distance of 150 feet, by a powerful voltaic battery of a very ingenious and peculiar construction, which he calls a *calorimeter*. He says that the same process might be applied for blasting under water, but he does not mention that he had ever done so himself. Colonel Pasley, after comparing Dr. Hare's mode of firing charges simultaneously, with other modes which he also tried, considers the Doctor's method of soldering the wires together in two parcels, one to be led to one pole, and the other to the other pole, of the voltaic battery, to be the best, and not likely to be improved upon; but he has not adopted any of the Doctor's other arrangements, as they are not applicable to subaqueous explosions under difficult circumstances, and he neither uses the large nor small iron wires, nor the fulminating *powder recommended by Dr. Hare. His own experiments for firing several charges simultaneously have as yet only succeeded at* very short distances, because he had not a sufficient quantity of thick copper wire in his possession; and therefore was obliged to employ common bell-wires, only 1-16th of an inch in diameter, which are comparatively useless, the best conducting wires being those of 1-5th of an inch in diameter, which should always be used for great explosions, and none less than 1-8th of an inch even for small explosions or for blasting. The officers who witnessed the various experiments at Chatham are therefore of opinion that it would be absolutely impracticable to fire gunpowder under water at the distance of 300 or 400 yards by six of Professor Daniell's cells, with conducting wires only about as thick as a common bell-wire, as was asserted in a paper on the subject of blasting rocks by galvanism, published in a scientific journal for the month of May, 1838; instead of which, they think that to produce ignition by such wires at the last-named distance would require the operator to go to the enormous expense of providing himself with a most unwieldy battery of far greater power than has ever yet been used within the memory of man, for in their own experiments they never succeeded in firing a subaqueous charge, even at the distance of 100 feet, by fewer than eight cells, with common bell-wires; whereas, in using the large wires, the same number of cells was found capable of producing ignition at five times that distance.

We shall conclude by mentioning with due applause the extraordinary success of Mr. William Snow Harris, of Devonport, who did wonders in firing gunpowder by wires led through water at a great distance by the common electrical machine in 1823. But for a detailed account of the interesting experiments of this justly celebrated electrician, which astonished a number of distinguished naval officers and other spectators at Devonport at the period alluded to, we must refer to the *British Press* newspaper of the 17th of March of that year. Notwithstanding this brilliant success, the voltaic battery must be considered preferable to the electrical machine, because the latter requires a much longer apprenticeship to use it properly; and one cannot expect such skilful manipulation as Mr. Harris has displayed either from military or from civil miners; besides which, that gentleman worked from a warm dry cabin, which is indispensable to the success of the electrical machine; whereas in the experiments of the engineers at Chatham the charges were always fired from Daniell's voltaic battery in the open air, often when exposed to heavy rains, and on one occasion during a very violent snow storm.

ROYAL INSTITUTION—MR. EVERETT'S LECTURE ON PROFESSOR LIEBIG'S METHOD OF ANALYZING ORGANIC BODIES.

April 12.—*The Conversazione.*—The Friday evening meetings were not held during two of the Easter weeks. On the present occasion there was exhibited a working model of a locomotive engine and train, sent by Mr. Newman, the construction of which appeared to be as perfect and complete as could possibly be produced. There were specimens from Mawe, in the Strand, of the mineralogy of Derbyshire. Mr. Rigg sent some apparatus to be used in organic analysis, in which the method of Liebig is generally followed. There were exhibited some very excellent photogenic etchings in Mr. Havell's style, whose method was described in our last report. Mr. Wilmore has in this way produced something which an artist can look upon with pleasure; he has more than realized our expectations, for he has shown that the process is susceptible of great delicacy of execution. It is, however, greatly to be regretted that Mr. Havell should have been prevented by a serious illness from being himself the first to prove what beautiful effects can be produced by his method.

The Lecture.—Mr. Everett took for his subject "Professor Liebig's method of analyzing organic bodies." The object of the Lecturer was to exhibit the apparatus precisely as adopted by the Professor; and to explain his method, by showing experimentally the process itself, in that minute and literal manner, and with all those precautions requisite to ensure the utmost accuracy of the results, as should constitute the lecture a lesson of practical laboratory instruction, so that even the adept may gain information, if wishing to attempt the same or similar manipulations. The reader will therefore perceive the difficulty of giving the substance or spirit of such a lecture; and to enter into details would, in a report and without diagrams, be absurd and unintelligible. A few cursory remarks must therefore suffice.

Organic bodies are separable into what are termed proximate principles; these again can be resolved by ultimate analysis into their chemical elements. The principles are characterized by this peculiarity, that with one or two exceptions (such as urea allantoin and oxalic acid) they cannot synthetically be re-constituted. Analysis, then, being all that the chemist can as yet accomplish, it has become an object, in the present advanced state of science, to make it as perfect as possible; to obtain not merely a knowledge of the constituent elements, but to ascertain their exact quantitative proportions. It has been found that this can be effected with the greatest exactness, not by collecting them separately as formerly practised, but by combining them as they are evolved with other bodies, and ascertaining their quantity by the increased weight which is produced. Thus in the case of sugar, which was the substance experimented on, oxide of copper was introduced along with it into a glass tube; heat was applied; the carbon combined with the oxygen to form carbonic acid gas, and was absorbed in its passage through a tortuous glass vessel, by a solution of caustic potash, while the hydrogen gas evolved, combining also with oxygen, formed water, and was absorbed by some chloride of calcium placed in a glass tube through which it passed. A comparison of the previous and subsequent weights gave by proportion the quantities of carbon and hydrogen contained in sugar. The mode of ascertaining the quantities of other elements was shown, and also the precautions which are necessary by exhaustion and other means, to prevent the access of moisture from the atmosphere to vitiate the results. Among the precautions necessary, is the use of Bohemian glass for the tube, it having no lead in its composition, and being made with potash instead of soda. The expedients and arrangements were ingenious and judicious, and the nearness of the results of several experiments gave proof of the extreme accuracy with which the process may be conducted by means of this apparatus. We were glad to observe, that though the lecture was by no means of a popular nature, (yet excellent of its kind) it was listened to with deep attention by *the great majority* of the audience.

Remarks.—It appears to have been overlooked by the cultivators of organic chemistry, that tannin is among the few proximate principles which the chemist is able to form from their elements. Hatchett succeeded many years ago in producing this substance from *inorganic* materials, namely, from nitrous acid, water, and carbon. Sugar from rags and similar cases are, as Mr. Everett remarked, merely modifications of existing organic products. We are not, however, to imagine, as some are disposed to represent it, that because these proximate principles are at present elaborated only by organised bodies, and are indebted to vitality for their origin, there is thus constituted a real distinction between them and merely chemical compounds. A character of peculiarity is thus assigned to them, it is true, but the circumstance is characteristic rather of our own ignorance and impotence, than of any line of demarcation, natural or scientific. Vitality is certainly the remote and ruling cause concerned in these productions, but as

the instruments and working agencies of this mysterious energy are, without doubt, the chemical forces, and as these, the immediately acting causes, though incited by a higher power yet operating in conformity to their own laws, are, in a very considerable degree, placed at our command, the subject is at once seen to be potentially within our reach; and we have only not actually succeeded in effecting these combinations, because we have been too coercive in our measures, and too impatient in our expectations.

NOTES AND NOTICES.

Holborn Hill.—A model of an invention to remove the danger and inconvenience arising from the steepness of Holborn Hill has been exhibited to the sitting Aldermen at Guildhall, by Mr. Seymour, a chronometer-maker, of Bartlett's Passage, Holborn. It consists of three lines for the passage of carriages, the line for ascending the Hill having its centre paved as at present, but the wheels to move over a succession of iron rollers, the rollers moving round as the wheels passed over them. The effect is stated by the inventor to be equivalent to diminishing the weight of a waggon load to 1-8th of the actual amount—that is, a horse would draw up 24 cwt. over the rollers with the same exertion as he would apply to 3 cwt. on the present pavement.

Lithography.—An application of lithography to pottery has been effected by M. Legé, the proprietor of one of the largest lithographic establishments in Bordeaux. By means of this invention, for which a patent has been granted, common plates and dishes will bear copies of many of the great works of the first painters.

Manufacture of Soda.—One of the most valuable improvements of modern times, and for which we are indebted to the chemist, has lately been achieved in the manufacture of soda from common salt by the use of carbonate of ammonia, instead of the pestiferous method hitherto employed in the production of that alkali; the necessity of decomposing the chloride of sodium by sulphur no longer exists, the newly discovered process being perfectly free from all noxious vapour. Another important advantage is also secured, namely, that the improved method can, with little additional outlay, be adapted to the manufactories at present in operation, and the workmen who have hitherto been frequently thrown out of employment and subjected to the loss of their wages in consequence of the numerous indictments that have been laid against their masters for nuisances will no longer be subjected to this evil.—*Morning Chronicle.*

Improvement in Gas Making.—We have been favoured with a view of a most beautiful and ingenious *Self-Acting Gas Apparatus*, patented by Mr. W. Holme Heginbotham, of this town, which has been a considerable time in operation at the works of Messrs. John Marsland and brothers, and gone through a series of experiments, the result of which is highly satisfactory. The retort, which is four feet long, produces upwards of 8000 feet in 24 hours, being three times as much as can be made upon the present system from one retort. The gas has not only a much greater illuminating power, but is relieved from those impurities which have hitherto prevented the adoption of that most beautiful light in dwelling houses, and it extracts one third more gas from a given quantity of coal.—*Stockport Advertiser.*

French Invention—Defensive Boots.—Among the curious inventions exhibited in the French capital during the present year are a pair of "defensive boots," having in each of the legs a pistol, immediately under the sole a little case for bank-notes, and in each end a dagger, arms both sufficiently portable and defensive; and a musical instrument, which serves either for a violin or a pitcher (!) being made of baked clay in a very curious manner.

Geology in Russia.—Some idea of the activity of the Russians in pursuit of science, but especially that of geology, may be gathered from the following statements: The Inspector in chief of the mines, the Count Cancrina, has for several years obtained His Imperial Majesty's permission to make geological and mineralogical researches in various parts of this vast empire, and a scientific committee has been established to superintend the publication of a work entitled "Annals of the Russian Mines." M. Parrot, Professor at the University of Dorpat, was ordered by the Russian Government to explore Armenia and Transcaucasia, and he placed his barometer at the top of Mount Ararat, which he found to be of volcanic formation. M. Kupffer has determined the height of Elbrous, the culminating point of the Caucasian chain. and is at this moment making meteorological and magnetic observations throughout the empire.—Baron de Humboldt and M. Rose have traversed the northern mountains. M. de Pusch has described the chalk formation in the south of Poland, M. Pander those of the neighbourhood of St. Petersburgh; M. Dubois de Montpereux has for years been devoted to the same researches in Caucasia, the Crimea, and Podolia, and M. de Verneuil has also visited the Crimea. M. de Semenoff, principal engineer of mines, has described the geological formation of the northern part of the Altaï Mountains, the central crest of which is composed principally of granite, and granitoid syenite, which are often at the base adjoined to mica slate. The lower regions are marly and covered with forests, which disappear in the regions of eternal snow, and from the alluvial soils which load the shallows and beds of the rivers, gold is now plentifully extracted by washing. M. Amixine has thrown light on the western ramification of the chain of Jablonowoë, in eastern Siberia, in which granite and mica slate predominate, and a formatiôn of porphyry of fifteen square leagues is on all sides surrounded by granite mountains of great elevation. In this same chain M. Fileff also found red sandstone, diorite, and a trachitic formation. The Altaï and Aral seem, however, to have been most explored, from the rubies which they present. Not only have they rich veins of gold, but lead, and garnets, tourmalines, topazes, amethysts, aquamarines, and the finest emeralds. On the coast of the Caspian Sea are hills, which contain an abundance of fossil shells, and strata of gypsum and rock salt. A great extent of coal is found in the chain of Donetz, and in the government of Karkoff.—*Athenæum.*

Hancock's Steam Carriages.—We observe by advertisements in the daily papers, that Mr. Walter Hancock has prepared his largest steam-carriage, the "Automaton" for traffic, and offers to enter into engagements with responsible parties to run on any ordinary turnpike road. What has become of Sir James Anderson and his drag?

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough-court,* Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

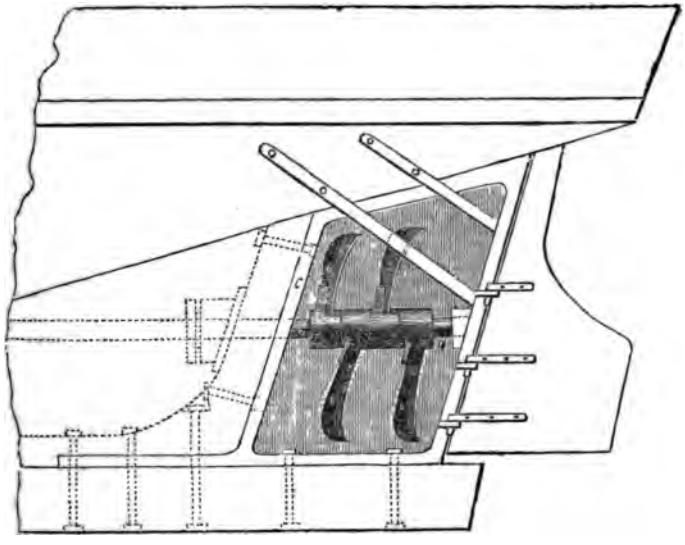
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 820.] SATURDAY, APRIL, 27, 1839. [Price 3d

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

LOWE'S PATENT METHOD OF PROPELLING VESSELS.

Fig. 1.



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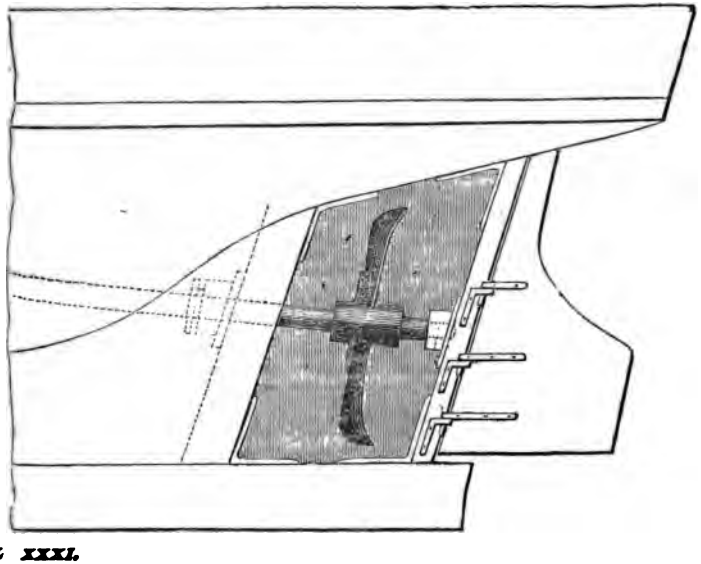


LOWE'S PATENT METHOD OF PROPELLING VESSELS, PARTICULARLY ADAPTED TO CANAL NAVIGATION.

Figure 1 represents so much of the stern of a vessel having the apparatus applied thereto for propelling, as will fully explain the nature of the invention. *a* is the shaft or axis on which the curved blades are set or affixed; this shaft or axis is to receive rotatory motion from a steam engine or other suitable power. *b b* are four curved blades, each a portion of a curve which, if continued, would produce a *screw*, but *screws* have been heretofore attempted to be used, and have failed of success, which has been owing to the water not being able to pass away, but producing a chokeing action; and this invention is such, that there being only sections or portions of a screw employed, each blade is a propelling instrument which allows the water to pass away in all directions, except at that point where the instrument is in full action; hence there is no chokeing or holding the water towards the centre of motion, which is the case in using complete screws.

Figure 2 shows a propeller, of the shaft or axis having two blades or sections of a screw, one placed in the same line with the other, which would also answer with one blade; but although this is an important improvement over the use of a complete screw, yet so far as experience has gone, such arrangement has not been found so good as the using each section of a screw or blade out of the line of all other blades, as is shown in figure 1.

The blades, it will be seen, are at the stern of the vessel, and the shaft on a line parallel with the keel; the shaft in passing through the vessel below the water line passes through a stuffing box, in order to render the same water tight. It should be stated that the patentee does not confine himself to the precise plan above described, as a shaft or shafts below the water line having similar propellers may be used at other parts of the vessel, such as at the sides, or at the dead wood, but such arrangements are not so convenient as those shown in the figures.

Figure 1 shews the manner of adapting the propeller to a vessel of the usual shape, *c c* being an iron frame bolted to *the keel, &c.,* of the vessel, and within *which frame the propeller turns.*

Figure 2 shows the form of construction recommended to be adopted in building a vessel purposely for being propelled by this plan.

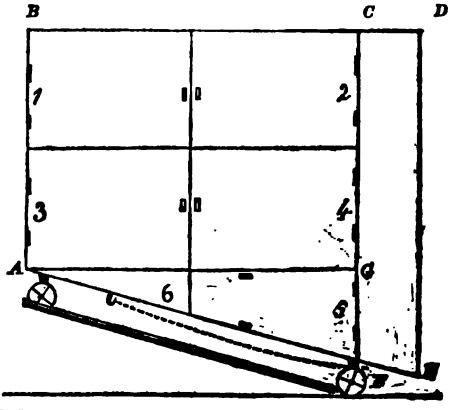
A small vessel, the *Wizard,* of 50 feet long and 8 feet beam, has been for some months employed as a barge tug on the Thames, and another is in the course of construction.

FIREPROOF SAFES MADE MOVEABLE.

Sir,—I take this opportunity, through the medium of your valuable Magazine, of addressing some observations upon a subject which must surely, to a great portion of the industrious public, most especially embracing those in the banking and mercantile interest, be of considerable importance, namely, the use of "Safes" (if they can be satisfactorily so called), fireproof, or intended to be so, for the preservation of papers and valuable documents. Much care, pains and expense have for years been bestowed in endeavouring to make these chests or boxes proof against the devouring element, by means of iron, placing them in walls themselves for protection, &c.; and yet in cases of a total destruction of premises, which constantly happens notwithstanding the active exertions of the fire engine department—take for instance the burning of the Royal Exchange—numbers of persons must suffer considerable anxiety not merely for that night of the fire, but the next day, aye, even till the ruins and rubbish are cleared away, to know the fate of their books, papers, &c. At the late fire alluded to some of the safes proved anything but safe, with the exception, perhaps, of Mr. Marr's, stated in the papers to have performed wonders. I am aware of some invention (of French origin I think) stated to be quite efficacious in making linen and even muslin proof against fire, and that paper of the same sort would only carbonise, but would leave the writing or numbers and value of bank notes still legible. However this may, for a long time to come, be more curious than common. Of course little can be said against the safety of the vaulted strong-room made under ground, common in modern buildings, though the removal of things out of, and into it, must occa-

tion daily trouble and inconvenience, even where done by the aid of some machinery, which then makes the whole very expensive. Notwithstanding the above, I ask still whether it would not be a great satisfaction to bankers, merchants, &c., to have the means close at their elbow, and at *any* moment of the day, of putting their books on shelves, and their papers, notes, &c., along with them, in what may be made fully deserving the name of a safe, and yet be portable, or rather *moveable* from the building *altogether*, in case of fire? Such a convenience is, in my opinion, both practicable and perfectly safe, and may be effected in the following manner:—

Fig. 1.



Let figure 1, A B C D E, represent an iron closet or safe made in the same sort of manner that safes are generally made —seven feet in height, and the width from B to C seven feet, the upper part between the letters A B C G occupying five feet or more out of the seven in height for the placing of four shelves above each other, with a strong division down the middle for the purpose of locking the four doors forming the front, and represented by the figures 1, 2, 3, 4, with two hinges to each door placed at the sides near each figure in the diagram; the four shelves in height being made so as to receive a considerable number of the books of the firm or house of business: then with seven feet in height, and taking five feet from C to G, the whole of the lower triangular compartment within the letters A G F will form, as it were, one safe or strong box for containing valuable papers, bills, notes, cash, &c., the door thereof being the division marked 5, with two hinges near the figure as placed, and two good locks as also placed at the other sides; the remainder of this part marked 6, may be made closed fast, and will strengthen the whole. *Let the whole of this closet or safe be in depth about 16 inches, so* as to take large books on the shelves, and with this *last* measurement let an opening be made into the street or some open yard through the wall of the banking or counting-house the proper height and 16 inches wide, so as *exactly* to admit the whole frame, and let this opening in the wall be so made that this closet or safe can be inserted exactly along the cross wall or *side* of the room where it is intended to be. Having explained thus far, it will be observed that the upright part of this frame between the letters C D E F should be hollow, of the same thickness as the wall itself, so that the hinges upon the line C F may open properly, within the room. The only thing now necessary to make the safe moveable and manageable are four strong iron wheels, six inches diameter, set on to the base at the points A F, the two at F to have an axle-tree made to turn on a pin in the centre, like the fore-wheels of a carriage or waggon, and the inclined plane below of strong thick wooden plank, with a ledge at each side for the higher wheels to run within as represented. It may be asked why this inclined plane? but the answer must be obvious, the mechanical advantage of the inclined plane being well known, be-

sides having in this case the additional assistance of the wheels at A to facilitate the motion of the whole. And here, let me remark, is the great advantage of this shape and construction, for had the whole frame been like a chest resting upon a square base on the level floor, it would have required the united efforts of several strong men to withdraw it from the wall, whereas now, notwithstanding that the weight of the frame itself when empty, may be, say one ton, or a ton and a half, and when filled with books, &c., half a ton more, yet at the very moment that the force of two ordinary men is applied to move or to overcome the inertia of the small proportion, as it were, over the front wheels between C and F, the greater weight of the frame between letters C and A will act as power, and, if it may be so said, do its own work, by forcing *itself* down the inclined plane. The whole frame thus easily sliding out of its place it must be made secure when put up in its proper place, and this is very easily effected by a strong bolt with a good sized handle to it, and, if desired, a strong lock in addition, both properly affixed to the wall inside the premises to fasten into the upright piece between letters C and F; but in case a lock be used as well as a bolt, the key should be suspended close by with a bit of chain, so as to be ready for use on any emergency. Of course the *end* of this iron frame or safe visible outside the wall must be made to fit the aperture properly and *closely*, as it is represented by the letters *a a a a* in figure 2, and the whole rendered almost imperceptible by being painted to suit the rest of the wall. For greater neatness still, the end of the frame or safe itself may be concealed by the application or screwing on of a pilaster, see figure 3, which might be of the most simple description; or moulding even made of wood, and to match any other near the adjoining door or window, and painted as before. The above demonstration has run to considerable length, but is thereby rendered such as would enable any person, if not to construct, at least to superintend the putting up of his own. And I will now anticipate some of the observations that may be made upon it.

That it may be made safe from plunder is quite as certain as with *any other* safe, the doors being made to shut in *flush* with the edges of the frame, and with Chubb's patent or any other favourite locks. The weight of the whole will of course require considerable force to place the frame upright upon the inclined plane, but that done, the great desideratum is, I think, obtained, viz., the speedy extraction of it in case of fire, which I would undertake to effect *when* the fire might extend to that room, by undoing the fastenings on the inner wall

Fig. 4.

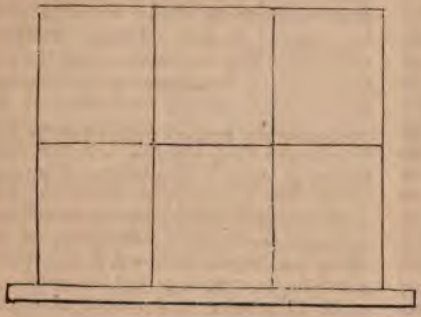


Fig. 2.

Fig. 3.

and applying the strength of only two *firemen or policemen to the* loops at *x x*, *which are the ends of two* bars forming *part of the iron safe itself,* but made to protrude through the surface outside; and the whole when upon the causeway outside may be removed from the conflagration with the further assistance of

two pieces of chain fastened to the axle-tree within each wheel at F, and allowed to hang under the base upon the hook near figure 6. The appearance of the whole frame or safe need not be the least unsightly inside the premises; by the erection of a wainscot at that side of the room, the doors to open so as to suit the front of the safe; and it is very easy for the person who has the charge of the premises and locking up after business is over, to look also to the safety of the fastenings on the wall as easily as to doors or windows. It will also be seen, that notwithstanding the shape of the upper part of this frame, yet when the wheels are upon the level, the centre of gravity is clearly within the base, and in moving it in the open air, the overturn to *either* side may be prevented by a loop in each side of the frame somewhere above figure 4; and to work within each loop the end of a moveable iron bar hanging close to the side and down within four inches of the ground, so that on any inclination either bar would of *itself* swing outwards and act as a prop or stay similar to the one under the shaft of a cart, or at the back of a waggon. I should not think there can be the slightest objection on the score of cost or expense, for other common safes require setting, as the term is, or walling up in some way or other. The safe made according to the above plan would be *much* too heavy and cumbrous to be carried off by thieves, and therefore there is the same degree of safety as with those at present in use dependent upon the goodness of the locks. If it should be said that the closet or safe on the above plan would not be sufficiently large and comprehensive for a large establishment, it will be very easy indeed, with the use of the *self-same* aperture in the wall, and therefore at *less* cost, to carry further on the wooden wainscot inside, and behind that and against the same wall to place another closet or safe of the same construction as the one above described, within the letters A B C F; and the above mentioned inclined plane itself being made a part of this second closet or safe, and strongly affixed by a sort of hinge at the side or end, will serve well to draw it or run it out after the removal or extraction of the first. I *should be sorry to have troubled you with the above, if any thing of the* same sort has been attempted before, but I am not the least aware of it. For my own part, if I were the owner of any considerable establishment, I should feel much more comfortable and at ease, if, besides the house and fixtures being insured, I knew that my safe, with books, bills, papers, notes, &c., could, in five minutes after the premises take fire, be delivered to me *unscorched*, by the policemen or firemen, instead of waiting till the conflagration be over to know whether what was considered the safe, has really and truly proved a *cool* protector and a trusty friend; and though great credit may be due to the efforts and exertions made by all members of the fire engine department, yet if a contrivance like the above can in a few minutes restore to the owner the chief of his valuables, it must surely be worth some little additional trouble, and particularly when so great an advantage is gained by the books, papers, &c., being actually *always* in the business room in their proper place, and what is more, perhaps year after year without even any alarm of fire at all, and therefore though *ready* for removal, yet by this plan entirely saving the trouble and confusion of *daily* removing them into any strong room under ground and restoring them every morning.

From my present situation in life I cannot indulge so much as I could wish in mechanical pursuits, but am still much interested with and a sincere well-wisher to your instructive and useful Magazine.

F. W.

February, 1839.

ERICSSON'S HYDRAULIC WEIGHING MACHINE.

[From the Transactions of the Society of Arts.]

Sir,—Agreeably to your instructions, I beg to hand you a description of the weighing instrument, which I had the pleasure to present to you last week.

In submitting this invention to the Society of Arts, permit me to observe, that the model presented was made more than a year ago, and that it has been tried under various temperatures, and always found to indicate alike.

I also beg to state, that I have been induced to claim the attention of the Society of Arts only from a strong con-

viction that the peculiar features of my hydrostatic weighing instrument cannot fail to render it of much utility to the commercial community, by greatly facilitating the business in docks and warehouses; to carriers, in particular, I believe it cannot fail to be a welcome present.

I am, Sir, &c.

J. ERICSSON.

A. Aikin, Esq., Secretary, &c.

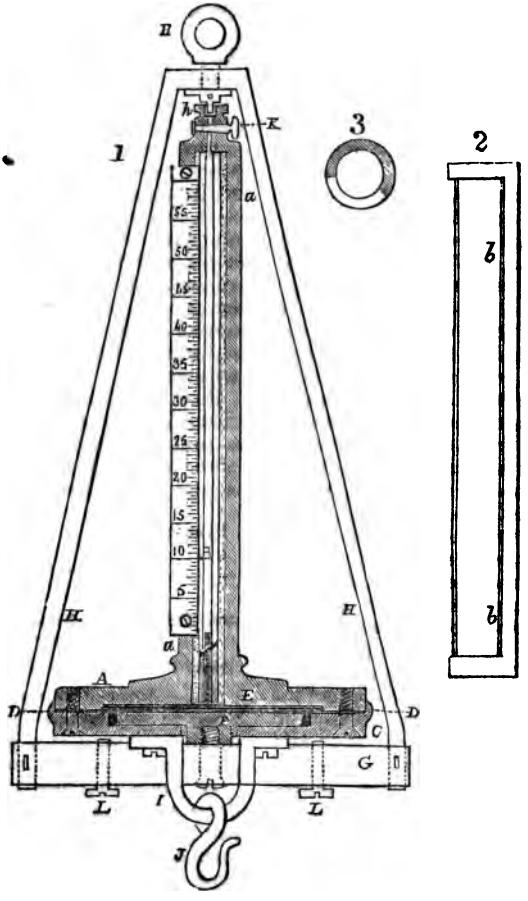
The object of this invention, is that of dispensing with the use of weights, in all ordinary weighing in which ounces are not counted. The principal features are:—

1, That the instrument is not subje to any friction; hence, that its accura is not, like the balance, affected und heavy weights.

2, That the motion of the parts i almost imperceptible, wear and tear bein thereby prevented.

3, That the weight may be read a the moment the article is suspended.

4, That by suspending the instru ment in the ordinary hoisting tackle the precise weights of goods, &c. may b obtained by the very process of loadin or unloading.



Description of the annexed drawing, representing a section of the model.—Fig. 1, A is a shallow inverted box of cast iron, with hollow stem *a a*; in this stem is inserted a glass tube folded in plaster of Paris. C is a pla

of cast iron with a wide recess in it, firmly secured to the box A, a piece of India rubber cloth D D, being inserted between them, so as to form a tight joint. E is a small quantity of mercury contained in the box A, and resting on the India rubber cloth D D; this being supported by, and fixed to, a plate or piston F. This plate rests on, and is firmly attached by a screw to the under cross-bar G; and this bar is suspended by two rods, H H, and the swivel eye-bolt H, which is partly inserted into, and made to slide in, the stem *a a* at *h*. I is a loop fixed to the bottom of the plate C, without touching the cross bar G; it has a hook J correctly under the centre, to which hook the article to be weighed is suspended. K is a small stop-cock, which may be shut whenever the instrument is not in use; it will prevent any mercury from escaping when moving the instrument, or should it chance to be placed in a horizontal position. Rather more than one quarter of the circumference of the stem *a a* is cut away, to show the tube, and let the rise of the mercury be seen, the index-plate is screwed to one side of the opening. Though the glass tube is protected by nearly three quarters of the stem *a*, yet a further security is provided for it when out of use. A tube like fig. 2, and 3 its section, is slid over the stem before the index-plate is screwed on: this slides round one way, to show the glass tube through its side opening, and back again, till its margin *b b* comes against the index-plate, and shuts the glass tube quite up.

The plate F, with the mercury on it, is supported by the rods and eye bolt, H. The weights of the stem, *a a*, with all its parts, the plates A and C, the loop and hook, I, J, are always floating on the mercury; which, in consequence, rises in the tube to balance them. From this surface the number on the index begins. All articles to be weighed are, through the hook J, supported from the plate A, which causes it to press so much more on the mercury, and drive it up the tube enough to balance the weight appended.

It may be convenient to place two adjusting, or safety screws, L L, in the bar G, the upper ends of which shall stand high enough to prevent the plate *c* from descending so low as to spill the mercury over the top of the tube B, should any article be hung on whose weight exceeded the range of the instrument.

The limit of the power of the instrument for weighing will depend on the diameter of the piston and box, and the length of the glass tube; thus, for instance, a piston and box of about 16 inches in diameter, with a tube of three feet, would weigh above 3600 lbs. It is worthy of notice, that the greatest motion of the piston in an instrument of this size will only amount to $\frac{1}{100}$th of an inch. The effect of changes in the temperature will, evidently, be an increase or diminution of the specific gravity of the mercury; this will, however. not effect the accuracy of the indication, for, though the mercury dilates more than the materials of which the box and piston are composed, still it can only affect the indication in a direct proportion to its expansibility. A slight error in the indication still remains, which will be completely corrected by fixing the index-plate at its lower end only, allowing the top free motion during changes of temperature. Regarding the construction of this instrument, it is of importance to make the bore of the glass tube, in all cases, $\frac{3}{10}$th of an inch, and the space between the circumference of the piston and the box should never exceed that dimension, however large the instrument may be.

HARPER AND JOYCE'S PATENT SUFFOCATING APPARATUS.

Sir,—I copy the following off-hand paragraph from a weekly newspaper of the past month:—

"*Suffocation.*—On Tuesday an inquest was held before Mr. Baker, at the North Country Sailor, High-street, Wapping, on the body of William Malcolm, a seaman belonging to the *London*, steam-ship, trading between London and Dundee, who was suffocated in a cabin on board that vessel by the incautious use of a stove known as Joyce's Patent Apparatus. The verdict was, "That William Malcolm was suffocated by breathing the sulphur and noxious vapour arising from a stove in the cabin in which he was sleeping."

It does not appear, from this very brief report, whether the coroner and jury were assisted in their deliberations

by the eminent scientific characters whose names have acquired so unenviable a notoriety from the use their owners have suffered to be made of them, in the attempt to puff this "patent apparatus" into favour, in despite of the proofs offered to the public almost from the first moment of its existence, of its exceedingly dangerous character. Nor does it appear whether the "proprietors" of the homicidal invention insulted the jury-room by their presence, as in the first case of death from the use of their machine, to endeavour to persuade the jury, in spite of common sense as well as science, that the deadly vapour emanating without control from their precious contrivance, *could* not have had anything to do with the accidental death of the victim. Whether they took this trouble or no, it appears that the jury, in this case, felt no hesitation as to what cause the horrible event was attributable, and determined (they could not well do otherwise) that the deceased was "suffocated by breathing the noxious vapour arising from the stove" recommended to the public by no less a personage in the scientific world than Mr. W. T. Brande, with all the weight derived from his professorship at the Royal Institution, and his well-salaried situation in her Majesty's mint.

But is this all? Is there to be a verdict of a jury, and nothing more? And are Messrs. Harper and Joyce to be allowed to go on, selling (if that may be) this "suffocating" apparatus, and backing their advertisements with the favourable testimony to its merits of Messrs. Cooper and Brande? It was some time ago inquired in the *Mechanics' Magazine* (before any fatal *accident* occurred) whether an indictment for "manslaughter" at least would not lie against the patentees, in case death should occur from the use of the apparatus, seeing that there could be no doubt of the deadly nature of its action. The question now requires reiterating, and with it another, whether Messrs. Cooper and Brande might not be included as accessories before the fact; inasmuch as it has been principally through the credit given to their sanction that the stove has been able to keep before the public at all. It may indeed be suggested that these gentlemen (especially the latter) will eventually suffer *sufficiently in the loss of* reputation *which must be the inevitable* result; but this will be poor reparation for the unfortunate William Malcolm's loss of his life!

It may be urged that Mr. Brande's share in the affair is not great, and that the approbation he has bestowed on the apparatus, if his words be strictly examined, will be found not near so great or of so comprehensive a character as has been supposed. This is true to a certain degree; but it cannot exculpate him or restore him to that eminence he enjoyed before he lent the weight of his name to the Harper and Joyce humbug. Aware as he must have been that its use must necessarily be attended with deadly consequences, he suffered his name to appear in such a manner as to give "the crowd" at least the idea that he held it to be innocuous; and this, too, merely for the purpose of puffing a quack invention into notice. If respectability of character can be held along with conduct such as this, to what a low ebb must scientific morality have fallen!

It does not appear whether any of the cases at Downham, in Norfolk, have terminated fatally; it is to be hoped not. It is truly amazing, and a rather melancholy proof of the slow march of information in the 19th century, that the worthy parishioners set on foot an inquiry as to whether the mischief was to be attributed to Joyce's or Dr. Arnott's stove, they having shown their wisdom by employing both these new-fangled schemes to warm their church. Of course Dr. Arnott's came off triumphant; mephitic as it might be, its suffocating powers were of course nothing in comparison to those of a stove which sends out all the products of the combustion of carbon into the atmosphere of the apartment. The bringing out of Joyce's stove has indeed been truly fortunate for Dr. Arnott's and contributed not a little to its (now-nearly-over) "run." People with a stock of two ideas, when they found that Joyce's stove had an absolute *deadly* effect, while Dr. Arnott's had not, at once ran away with the notion that the doctor's was quite unexceptionable. The illustrious Morison might take a hint from this: it is remembered now that his gamboge and aloes *do* kill now and then; but let him get some other quack to compound *his* pills of pure arsenic, and their superior potency will

soon *make* the Morisonian appear "perfectly innocent!"

I am, Sir,
Yours respectfully,
H.

April 22, 1839.

REMARKS ON SOME PREVAILING MISCONCEPTIONS CONCERNING THE ACTIONS OF MACHINES—BY EDWARD SANG, ESQ.*

In this paper I proceed to expose the fallacy of some prevailing notions concerning the actions of machines in general.

The fancy that machines are capable of generating power, though fostered by a very absurd proclamation from our government, is now almost entirely abandoned; and, except from two or three individuals ignorant of the history and of the principles of mechanics, we hear of no attempts at obtaining the reward offered for the perpetual motion. But another fancy differing less from this than it at first appears to do, is very generally entertained. We are perpetually told of the loss of force which arises from the obliquity of the actions of machines, and are called upon to examine cumbrous and expensive contrivances for rendering these actions direct, and for regaining, or even more than regaining, the force that has been wasted. If any arrangement of machinery were capable of destroying force, putting friction out of view, the inverse action of the same machinery would be capable of generating it.

The truth is, that every machine, however ill contrived, and however ill constructed, delivers over the whole, and exactly the whole, amount of force which put it in motion. Part of that force is expended in overcoming the friction of the rubbing surfaces, and in encountering the resistance of the air, while the rest goes to produce the particular effect which the contriver of the instrument may have had in view.

The geometric contrivance of machines, the arrangement of the parts so as to produce particular motions, has unlimited scope. But in a mechanical point of view, the inventor can, profitably, direct his attention only to two objects—economy in the material and labour necessary to the first construction of the instrument, and the diminution, as far as is practicable, of the effects of friction. Were all friction avoided, it would be a matter of absolute indifference by what means the required changes of motion might be produced; it would then be of no moment whether we employed the reciprocating or the rotary steam-engine,—whether we used the crank, or the sun-and-planet wheel,—farther than the mere expense of workmanship is concerned. And we have no other criterion for estimating the superiority of one contrivance over another than the comparisons of the amounts of friction in the two cases.

These statements will be startling enough to persons half acquainted with the nature of machinery. "What," they will ask, "does the obliquity of the crank cause no loss of force? Is there no force wasted in producing the reciprocating motion of the beam in the steam-engine? And were they mere dreams that we entertained of immense improvements in machinery?" And when I assert, what is well known to every one acquainted with the subject, that there is no loss of force from the oblique action of the crank, that there is no force wasted on the reciprocating motion of the beam, and that the removal of friction is the only source of improvement in machines for transferring power,—I oppose the prejudices of multitudes who ought to be better acquainted with the principles of mechanics.

The principles which regulate the balance of pressures, and the movements of bodies, though discovered by man, are not of human invention; they are laws impressed by the Omnipotent upon the material world—laws to which matter yields an implicit, a perfect obedience. These laws are few in number, and the simplest language in which they can be expressed involves the very statements I have made. To exhibit, then, the truth of these statements would be to examine the reality of the fundamental laws of mechanics. To this examination I will now proceed, but will content myself with founding my investigations on the more common forms in which these laws are recognised. They naturally divide themselves into two classes: those which relate to the pressures of the acting parts during any momentary state of the machine, and those which relate to the properties of the machine considered as in motion. Those of the first, or statical class, though at first sight very numerous, are summed up in one law, called the *principle of virtual velocities*. My first object will be to exhibit this principle in a clear light; not, indeed, as I would do in a scientific treatise on the subject, but in such a manner as appears to me to be best fitted for removing those prejudices, the existence of which has occasioned this paper.

When two weights balance each other by means of the wheel and axle, it is well known that they are to each other inversely as the diameters; but if the machine be turned a little round, the distances through which

* *Read before the Society of Arts for Scotland, 9th January, 1833.*

weights move are directly as the same diameters,—so that, if each weight be combined with the distance through which it moves, the two results are exactly equal to each other. The descent of one pound through ten inches would, for example, be accompanied by an ascent of ten pounds through one inch, and thus whatever is gained or lost in intensity of pressure, as much is lost or gained in distance. It will be readily seen that the same thing is true of the straight lever, and of those combinations of pulleys which have their strings parallel; but in the case of the *inclined plane*, of the *bent-lever*, and, in general, of all machines in which the relations of the pressures are altered by a change in the position of the instrument, the application of the same rule is not so easy; and the slight difficulty that attends it has elicited the assertion, that the principle of virtual velocities is there at fault.

The relative motions of the different parts of a machine can easily be deduced from its geometric properties. The principle of virtual velocities enables us, from these motions, to compute the forces, and thus connects the geometric with the mechanical properties of machinery. This principle, one of the most beautiful and most pervading in nature, may be thus expressed:—

If the position of any machine be slightly disturbed, and if each pressure which has yielded, be combined with the distance through which it has yielded, and each pressure which has advanced, with the distance through which it has advanced, the sum of the one set of results will be exactly equal to the sum of the other set.

Now, in the case of the inclined plane, says the objector to the reality of this law, the weight raised and the weight which raises it, move over equal distances. The motion of the weight is here mistaken for the distance through which its gravitation is overcome; its absolute motion, for its motion in altitude; now, it is well known that the force requisite to drag a body up an inclined plane, is to the weight of that body as the height of the plane is to its length; and therefore the principle of virtual velocity is here adhered to. This misconception is palpable and easily corrected; the motion of the machine does not alter the proportions of the forces. But, in the case of the bent lever, the error must be more involved, since it has crept from the work-shop to the lecture-room, and has been promulgated where sound knowledge and accurate ideas ought to have rewarded the labours of the student. The arcs, we are told, which the ends of the *arms describe, are proportional to the lengths of these arms, while the balancing forces* are not proportional, inversely, to the same lengths. Here, again, the absolute motion of the point of attachment is mistaken for the distance through which the pressure is overcome. If, however, the objector's capacity be not entirely exhausted by the immense profundity of this remark, he will reply, and with justice too, that even estimating the motions in the directions in which the pressures act, the rule does not hold good.

For the removal of this mighty difficulty I must summon all my strength. Accustomed to handle tools (I speak not for myself only, but for every devotee of true philosophy), accustomed to handle tools admirably adapted for facilitating researches of this nature, and now called upon by the circumstances of the case to lay these tools aside and to venture on the question with unappareled hands, I cannot altogether divest myself of repugnance to the task. To render it, however, more inviting, I shall make the question as general as possible, and without confining myself to this, or any other individual case, apply my remarks to those machines generally, in which the forces vary with the positions of the parts.

Conceive that for a given position of such a machine, the pressures are so arranged as to balance each other, and then let the machine suffer a displacement. If this displacement be considerable, the equilibrium will be materially disturbed, and the estimate of the motions, far from giving information concerning the original forces, would commingle the means for determining the forces in all positions between the first and last, and would rather be the basis for determining the conditions of the mean state, than of either of the extreme ones. However small may be the displacement, still will there exist an error in the estimate; yet the more minute the displacement, the more inconsiderable will be the error, because there will exist the less difference between the two extreme states of the machine. In order, then, to compute the pressures accurately, we must determine the proportions which subsist between the motions of the parts, supposing that these motions are infinitely small. I know of no other method for effecting these computations than that contained in the Differential Calculus, or in the more abstruse but more satisfactory theory of Lagrange; and, although the name of fluxions be a bug-bear to thousands, it is absolutely impossible without its aid, to advance beyond the threshold of mechanical investigation. The advocates for mental indolence may urge that the statical properties of many machines may be examined without the aid of the fluxional calculus. Such is, indeed, the

case, and these machines and such methods of calculating concerning them, may afford lessons to the beginner; but from such processes, few, if any, general conclusions can be drawn, while the instant that motion is contemplated, all these resources fail.

The principle of virtual velocities, such as I have defined it, holds true of all machines, even though subjected to the retarding influence of friction; and is applicable not merely during a momentary state, but also to the motions of machines. Denoting by the word *force*, the result of the combination of a pressure with the distance through which it acts; if the sum of the accelerating forces be just equal to that of the retarding ones, the quantity of motion in the machine will be unaltered, but if the two sums be unequal, then will the speed be changed. Now, in almost all machines the forces and velocities are subjected to periodic variations; the method then of computing the change in velocity consequent upon a change of force must be clearly understood, ere we obtain any information as to the general properties of machines in motion.

The great proposition which connects the statical with the phoronomic properties of machines, is this; that the change in the entire quantity of motion is proportional to the difference between the separate amounts of the accelerating and of the retarding forces; the quantity of motion being estimated by combining each moving mass with the second power of the number which represents its velocity. Now, I have already said, that whatever be the nature of a machine for communicating force, the amount of force delivered during a minute instant of time at the one end, is exactly equal (throwing out of view the friction and the weights of its parts) to that communicated during the same instant to the other end; so that the same change is produced in the entire quantity of motion, whether the force be applied directly to the moving mass, or whether it act upon it through the intervention of machinery. This most important principle I shall endeavour to illustrate by example.

Borrowing my illustration from the steam-engine, I shall suppose one in which the piston acts directly upon the fly-wheel, by means, say of a double rack working alternately on each side of a toothed wheel. Here it will not be denied that the accession to the quantity of motion in the machine during a half-stroke will be exactly what is due to the agency of the pressure of the steam upon the piston through the whole length of the cylinder, less, of course, by all the amount of all the retarding forces *during the same period. Contrast this with what happens in the common steam-engine.* Let the connecting rod be so nearly in a line with the crank, that a pressure of one hundred pounds on the piston exerts only a pressure of one pound in the direction of rotation; then does it follow, from the principle of virtual velocities, that if the piston advance minutely in the cylinder, the extremity of the crank will advance one hundred times as far along its path. The quantity of motion generated in the machine then will be what is due to a pressure of one pound acting through one hundred times the advance of the piston, or, what is the same thing, to the pressure of one hundred pounds acting through that advance itself. The same thing is true for every other minute motion of the piston, and, therefore, the whole amount of motion communicated to the machine through the crank is exactly equal to that communicated to it by means of the double rack and toothed wheel, or by means of any other contrivance whatever.

In the two arrangements, however, which I have contrasted, the motion will be divided among the parts in very different proportions. The manner of that distribution vitally affects the economy of the machine. The entire quantity of motion is not and cannot be concentrated in the fly-wheel; the piston and all the other moving parts must have their share of it. In the engine with the double rack, the piston and its appendages possess, from the beginning of a half-stroke until the end of it, their full velocity. During the half-stroke, therefore, none of the force of the steam is expended in generating the motion of the piston; but just when the piston has reached its extreme position, its whole velocity must be extinguished and generated in the opposite direction, and the consequence is, that the extreme tooth of the rack will receive a blow as if from a hammer as heavy as the piston and all its appendages, and moving with twice its velocity; and although no loss of force would arise from this action, its continued repetition would tear the machine to pieces. In the case of the balanced crank-engine, on the other hand, during the first part of a half-stroke, the velocity of the piston and beam is gradually increasing; at the middle their velocity is the greatest; and during the latter part it gradually decreases. In the first quarter revolution of the crank, the force of the steam is thus partly expended in producing the motions of the piston, beam, and connecting rod; but in the second quadrant, when these motions are being retarded, the force necessary to accomplish this retardation communicates an equal accession of motion to the fly-wheel. Still, then, is the whole force of the steam expended in overcoming the friction, and in producing

the particular effect which may be wanted; still is there no force lost on account of the obliquity of the actions, or of the reciprocation of the movements; and still is the diminution of the friction the only source whence increased effectiveness can be obtained.

I do not expect that what I have just said will be sufficient to eradicate misconceptions so prolific of crude and abortive schemes. The failure itself of the contrivance is often inadequate to convince its inventor of the fallacy of his ideas. Fortified in his ignorance by the fancy that theory is a different thing from practice, there is small chance of his yielding to the arguments of one whom he considers as a pure theorist. The fashion of the day, which puts diffuse and indistinct notions in the place of true learning, which cries for science levelled to the meanest capacity, or as I would translate it, to the most confirmed indolence, fastens these prejudices more firmly on the minds of the half instructed. Were the evils of this fashion to rest with those who turn to philosophy for relief from the ennui of idleness, they might have been passed over in silence; but when they reach that class to whose usefulness extensive information is essential, their removal becomes an object of the highest importance. It would not be proper for me, in the present paper, to venture into the depths of this subject; but the connexion between what is called *popular science* and many of those mistakes which are so current, is too immediate to permit of remarking on these without casting a glance, at least, to their fertile source.

Were the laws which regulate the phenomena of the universe, laws of human invention, and did they involve contradictions and absurdities, then, indeed, with some propriety, might the cry be raised, "They are too abstruse, they are too difficult; let us have them simplified and levelled to the meanest capacity." Level these laws, and they are no longer the laws of nature; the true method of seizing them, is to nerve the mind with higher powers; to infuse into it an exalted ambition, and to come to the attempt prepared for long-continued and strenuous exertion. Would effeminacy pave the way to the white summit of the Jungfrau? or, had your parlour hearthstones been brought from the summit of Ben-Lomond, think you that your delighted eyes could thence have wandered over lakes and mountains? No. He who would scan the wonders of nature, who would contemplate the wisdom, the beneficence of her works, and would use his acquirements for *the advantage of his race, must give himself enthusiastically to the pursuit*, and must scorn to turn from the difficulties in his path. Perseverance will crown his exertions with success; and the elevation of his mind, the calm and ineffable delight which accompanies the acquisition of knowledge, will, a thousand times, repay all his exertions. From the throne of science he will descry connexions and arrangements and sympathies among the passing events, and turning, with his colleagues, to the yet unscaled heights, he will emulously pursue the career of discovery. The present is a spirit-stirring time; on all hands have discoverers been at work; from north and south has the hitherto unpassed barrier been assailed, and already have the signals of the workmen on either side been descried by their fellow-labourers. Elated by the prospect of speedy success, they now redouble their exertions, and expect, ere long, to re-assemble on a higher platform. The science of mechanics has long reared its head proudly over its fellows. Under its efficient guidance, its indefatigable votaries have estimated the weights and motions of the heavenly bodies, and carried into the highest department of the science an exactness almost superhuman. Now, however, the sciences of chemistry, galvanism, and magnetism, advance rapidly to take their stations by its side, and promise to rescue from the charge of inconsistency the great laws of mechanics.

The precision which reason assigns to mechanical phenomena, the precision which these phenomena exhibit when the planets, launched in unfilled space, perform their mighty evolutions, fails us, when we lower our contemplations to terrestrial objects. Here the perfection of nature seems to be marred, the traces of absolute exactitude to be effaced, as if some evil genius had thwarted the Almighty in his design, and sowed confusion where order was intended. All motions on the surface of the earth are soon extinguished, and there was no wonder that men, in the infancy of science, drew the conclusion that matter possessed a reluctancy to move. It required a mind of no common energy to burst the shackles which education and early experience had combined to rivet, and to oppose its solitary strength to the bigotry of false religion and false philosophy. Unaided, Galileo long maintained the contest, and although at last the man fell, his doctrine was victorious. Since that time friction has been recognized as the antagonist principle, which opposes, and invariably succeeds in extinguishing, motion, which creates errors in the results, and uncertainty in the practice of mechanical operations. Far, however, from being the cause of the imperfection of machines, friction is essential to their very existence. Not a fastening would

be secure, not a screw would hold, were it not for its pervading agency. Without friction this world would have exhibited a scene of indescribable confusion. Conceive for a moment, its influence suspended, and where would be progressive motion? how would we climb the steep, how, even, would we walk along the plain? The mountain masses, rushing to the plains, and not arrested even there, as now, but hastening along with undiminished speed, would leave no spot for vegetable, no safety for animal life: though dashed to powder by repeated blows, each particle would yet move onward, and chaos would be realized. Far, than, from friction marring the general design, it, itself, is one of the most admirable and most beneficent provisions which nature's God has made for the felicity of his creatures.

When we glance over the vast fields of modern science, and contemplate the harmony that reigns among the known laws, when we consider the ease with which geometry is engrafted on arithmetic, the perfect acquaintance with geometric laws which is exhibited in the contrivance of the mechanical ones, we cannot imagine that the law of friction militates against or annuls one really existing law of nature. Chemistry has acquainted us with the permanency and indestructibility of matter; mechanics has taught us that the entire amount of momentum estimated in any given direction, is absolutely fixed, and has indicated that, except where friction and chemical changes interfere, the total amount of motion in the universe is unchangeable. The recent discoveries in galvanism and electricity shed a new light upon the subject.

The combustion of the coals, the chemical union of the carbon with the oxygen in the furnace of the steam-engine generates motion; that motion is extinguished partly by friction, and partly in effecting the disintegration of bodies; and it now seems more than probable that this rubbing and this subdivision of matter induces a state, and communicates that state to surrounding objects, which afterwards goes, in some distant quarter perhaps, to reproduce chemical changes preparatory to a new evolution of the like forces. Small indeed as that change must be when absorbed in the general mass, it is not on that account, the less real. The mass of stone that has been torn from the quarry, and fashioned into this splendid town, is minute indeed, yet, undoubtedly, that transference has retarded the rotation of the earth, although our senses, aided by every contrivance of science and art, be utterly unable to discern a trace of the change.

While, then, we zealously strive to improve our machines, and to remove the friction from the inefficient to be concentrated on the working parts, let us not repine that, after all our exertions, we are still compelled to resign a tithe of our labour to that influence under which alone it is possible for us or our machines to exist, and let us console ourselves with the thought, that, though our exertions be lost to us, nature has taken care that they conduce to the maintenance and well-being of the general system.—Edin. N. Philos. Jour.

ROYAL INSTITUTION.—PHOTOGENIC DRAWING.—MR. COTTAM'S LECTURE ON THE MANUFACTURE OF BRICKS AND TILES BY MACHINERY.

April 19.—*The Conversazione.*—The photogenic art continues to excite an unabated interest, and still furnishes the principal subjects for exhibition. Mr. Taylor sent a series of photogenic drawings, or copies rather, from engravings and natural objects, those of feathers being very delicate and beautiful. It appears from a letter addressed by him to Professor Faraday, that this gentleman does not use the simple solution of nitrate of silver, but an ammoniacal combination. Having dissolved one dram of nitrate of silver in three ounces of water, he first precipitates and then dissolves the precipitate, by adding ammonia drop by drop. This wash for preparing the paper appears to be much more economical than Mr. Talbot's, but it is our duty to add, that it is a most dangerous preparation. Even a pellicle that may form upon the surface of the liquid must not be touched, for Mr. Cooper, the chemist, says, that having ventured to do so with a straw, a tremendous explosion was the consequence. Mr. Taylor uses the hypo-sulphate of soda to prevent further action from light. One of the best specimens of the art, yet exhibited, was a photograph, the glass for producing which was painted by Mr. Havell in the manner described in a former report. We think the best effect would be produced by adopting both styles on the same glass, that is, etching and drawing, thus gaining strength and precision by one, and a blending of tints by the other; or two glasses may in some cases be used. The great desideratum, however, is to establish the process on such a basis as would afford entire confidence in the permanence of the results. Could this be secured, we doubt not that some of the first talent in the country would be employed in placing on glass what would in reality be undoubted works of art, whether we consider the fact or the effect; but at present the greatest uncertainty prevails, for the means employed to discharge the silver occasionally impe

fectly effects the purpose, and sometimes injures after a while both the precision and the depth of the drawing. Paper-makers too would do well to turn their attention to the subject, and make a paper expressly for the purpose.

The Lecture.—This was given by Mr. Cottam, "On the manufacture of bricks and tiles by machinery," or rather on the Marquis of Tweedale's machine in particular for this purpose. The Lecturer having only this one object in view, as we must suppose, thought it of course to be unnecessary to sketch the history of the previous attempts in this line of invention, or to refer to the several machines which are at this time actually competing for the favourable regard of those whose interests are concerned. By the aid of a working model and a few diagrams, the Lecturer easily succeeded in explaining that which we must attempt to do without the assistance of either. The machine is not constructed on the principle of imitating the manual operation, by forming the bricks in moulds, but it arrives at the same end in a different manner, and one more suitable to the application of machinery. The principle adopted is this—to form and protrude, by mechanical means, a continuous fillet of clay, of the width and thickness of a brick, and to intermit this act of protrusion for a moment, whilst a length of the fillet equal to that of a brick is cut off. This is effected in the following manner:—Two vertical roller wheels, one of them being placed over the other, and having an interval between them equal to the thickness of the intended bricks or tiles, are made to revolve in contrary directions; consequently they draw between them the clay with which they are fed on the one side (either by hand or by a pug-mill), and deliver it on the other in a highly compressed state, and in the form of a straight, smooth and even fillet of the width of the wheels. To provide for the squareness and smoothness of the fillet sideways, it is sufficient simply to prevent the clay from escaping laterally, when between the pressure of the wheels. The frame, between and close against which they run, serves this purpose. The clay is supported in a horizontal position whilst delivered to and received from the wheels, upon a short endless band on each side, revolving on rollers rather close together; and in order to facilitate this object the wheels themselves have bands, which are prolonged by means of rollers in the direction of the endless bands, and in the case of the lower wheel, in such a manner as to meet them and form one horizontal line. The best material for these bands is found to be fustian, the nap on which prevents the adhesion of the clay. The axes of the roller wheels are geared to each other by toothed wheels, and these are moved by a pinion wheel having intervals devoid of teeth. To this pinion the power is applied, and during the said intervals, in which the wheels not being acted on, the clay is not protruded, a lever is put in motion by means of a cam on the axis of the pinion, which lever having a forked end with a fine wire stretched across it, cuts off the desired length from the fillet every time a stroke is made. The clay being again protruded the same distance, by a similar set of teeth on the pinion, is again cut off during the succeeding interval to exactly the same length as before. Now the fillet of clay being double the width of a brick, a wire is kept constantly stretched in the middle of its path, thus dividing it into two fillets; and consequently at every movement of the lever, two bricks are cut off. Two boys are sufficient to remove them as fast as they are produced, which is at the rate of from 1500 to 1800 in the hour. The consistence of the clay is so much stiffer than in hand made bricks, that only half the time is required in the drying. From there being so little water in the clay, and from its undergoing so secure a compression, the bricks produced are remarkably dense and strong, whilst the ordinary brick weighs about 4½ lbs., the machine-made brick weighs 7½ lbs. The former will absorb 28 ounces of water and the latter only 4 ounces.

The same kind of machinery is applicable to the making of tiles, the distance merely between the wheels being required to be varied. The number made is the same per hour as of bricks. For the making of draining tiles, some further appendages are required. The fillet of clay, before it is finally cut off in lengths, is passed between and under rollers, acting as moulds to bend and press it into shape. In this way, whilst a man can make in a much less perfect manner, only 700 tiles a day, the machine can make 10,000.

Remarks.—A machine in which both the principle of the operation, and the mechacal form of embodying it, are precisely the same as are adopted in the machine of the Marquis, was described in No. 794 of this Magazine, as invented by M. Terrason, a French gentleman; the Marquis, however, appears to have been the prior inventor, his patent having been obtained in 1836. The Marquis's mode of cutting off the bricks, appears, by the bye, to be rather questionable, as compared with M. Terrason's, who says, that by his method more than 3000 bricks can be made in an hour. This arises from the circumstance, that in the Marquis's machine, the motion of the roller wheels must,

of necessity, be very slow, for otherwise the fillet of clay will not travel equally fast, and thus the bricks would be cut off too short; but in the French machine the velocity is not so strictly limited, and is determined rather by the practicability of taking away the bricks as fast as they are made. The defect in the wire-cut bricks, is, that the ends are rough and uneven, and this would be very much the case with the heterogeneous composition used by the London manufacturers. With them also, the very perfection of the machine-made brick, whatever plan may be adopted which augmented its density would be a positive disadvantage, for if the weight is increased one half, or in any other proportion, in the like ratio would the consumption of materials be increased. This we apprehend is the secret why the inventors of brick-making machinery have met with so little encouragement. The same objection does not apply so strongly in the case of tiles, and here also the saving effected in labour is greater. Query—would such dense bricks burn so well in clamps?

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 27th OF MARCH AND THE 25th OF APRIL, 1839.

William Overton, of Shovel Alley, St. George's-in-the East, gent., for certain improvements in machinery or apparatus for making ship's bread or biscuits. Patent dated April 3; six months to specify.

Thomas Edwards, of King-street, Holborn, writing and dressing case manufacturer, for improvements in the manufacture of hinges. April 3; six months.

Hugh Lee Pattinson, of Bensham, near Gateshead, Durham, gent., and **William Septimus Losh**, of Walker, Northumberland, gent., for improvements in reducing metallic ores. April 3; six months.

Josiah Marshall Heath, of Allen Terrace, Kensington, gent., for certain improvements in the manufacture of iron and steel. April 5; six months.

Jose Francisco Carlos d'Artenn, of the Haymarket, gent., for improvements in machinery for transmitting power, whereby the effect of such power is increased without loss of speed. April 5; six months.

James Nasmyth, of Patricroft, near Manchester, engineer, for improvements applicable to the bearings, or journals of locomotive and other steam-engines, which improvements are also applicable to the bearings or journals of machinery in general. April 9; six months.

George Stocker and **Joseph Bentley**, both of Birmingham, gunmakers, for certain improvements in guns, pistols, and other denomination of fire arms. April 9; six months.

Charles Adolphe Roederer, of Strasburg, but at present residing in Wellington-street, city, for an improved method, or process of manufacturing or preparing the chemical salts, called acetates. April 9; six months.

Thomas Parkin, of 22, New Bridge-street, Blackfriars, engineer, for improvements in rail road and other carriages, in wheels for such carriages, and in roads and ways on which they are to travel. April 9; six months.

Thomas Bonsor Crompton, of Tamworth, Bolton, Lancaster, for improvements in the manufacture of paper. April 9; six months.

Lemuel Wellman Wright, of Manchester, engineer, of an extension for the term of seven years of letters patent, granted to him for certain improvements on machinery or apparatus for washing, cleansing, or bleaching of linens, cottons, and other fabrics, goods, or fibrous substances. April 9.

James Clement, of Liverpool, carver and guilder for improvements in preparing mouldings, and in producing the effect of chasing, or embossing various devices, or patterns, on frames and other work. April 10; six months.

Joseph Gillott, of Birmingham, pen maker, and **Thomas Walker**, of the same place, machinist, for improvements in engines, and in carriages to be worked by steam or other motive power. April 13; six months.

Lot Faulkner, of Cheadle, Chester, calico printer, for certain improvements in the mode of working pumps or valves, and which improvements are also applicable to fire engines and other similar apparatus. April 13; six months.

Henry Crosley, of Hooper-square, London, C. E., for a new manufacture of paper. April 15; two months.

Laurence Rowe, of Brentford, soap maker, for improvements in the manufacture of sulphate of soda. April 16; six months.

Henry Curzon, of Kidderminster, machinist, for improvements in presses. April 16; six months.

Henry Dunington, of Nottingham, lace manufacturer, for improvements on machinery employed in making frame-work knitting, or stocking fabrics. April 16; six months.

John Swindells, of Manchester, manufacturing chemist, for certain improvements in the manufacture of Prussian blue, prussiate of potash, and prussiate of soda. April 16; six months.

James Fergusson Saunders, of New Bond-street, gentleman, for improvements in the manufacture of certain descriptions of paper, mill-board, paper maché, and other matters of that kind, capable of being produced from such description of paper pulp. April 20; six months.

William Crofts, of Radford, lace manufacturer, for improvements in machinery used in making bobbin net lace, for the purpose of making figured or ornamented bobbin net lace, and lace or net of various textures. April 20; six months.

John Potter, of Ancoats, Manchester, spinner, and **William Horsfall**, of Manchester, card-maker, for an improvement or improvements in cards for carding various fibrous substances, part of which improvements may be used as a substitute for leather. April 20; six months.

James Davis, of Walcot-place, Lambeth, Esq., for improvements in the manufacture of soap. April 23; six months.

David Stead, of Great Winchester-street, London, merchant, for an improved mode or method of making or paving public streets and highways, and public and private roads, paths, courts, and bridges, with timber or wooden blocks. April 23; four months.

Alfred Singer, of Vauxhall, potter, and **Henry Pether** of Wandsworth Road, for certain improvements in the preparation and combination of earthenware or porcelain for the purpose of mosaic or tesselated work. April 23; six months.

John Miller, of Bolton, machine maker, for an improved drilling machine. April 23; six months.

David Napier, of Mill-wall, engineer, for improvements in iron steam-boats. April 23; six months.

Elijah Galloway, of Water-lane, Tower-street, engineer, for improvements in steam-engines. April 23; six months.

Antonio Movillon, of Dorset-place, Dorset-square, gent., for improvements in machinery for propelling ship's boats and other vessels, on water designed to supersede the use of paddle-wheels. April 25; six months.

George Holworthy Palmer, of Surrey-square, Old Kent Road, C. E., for improvements in paddle-wheels, for propelling ships' boats and other vessels navigated by steam or other motive power. April 23; six months.

William Edmondson and James Edmondson, both of Manchester, engineers, for certain improvements in the machinery or apparatus for the manufacture of wood screws, and screw bolts. April 23; six months.

Job Cutler, of Lady Pool-lane, Birmingham, gentleman, for an improved method or methods of constructing chains for suspension bridges, cables, mining and other purposes, and for an improved method or methods of making the bars, links and bolts thereof. March 12; six months.—*Note.* A caveat having been lodged at the Great Seal Office, against this patent, the same was not sealed till the 23d of April, but bears date 12th March, by order of the Lord Chancellor.

John Browne, of Castle-street, Regent-street, Esq., for improvements in saddles and stirrups for horses and other animals, parts of which improvements are applicable to apparatus for carrying packs by men. April 25; six months.

James Barlow, of Birmingham, for certain improvements in the construction of candlesticks. April 25; six months.

John Jones, of Westfield-place, Sheffield, for a new frying and grilling pan. April 25: six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22D MARCH AND 22D APRIL, 1839.

James Gardner, of Banbury, Oxford, ironmonger, for improvements in cutting Swedish turnips, mangel wurzel, and other roots used for food for sheep, horned cattle, and other animals. Sealed 25th March; four months to specify.

George Cottam, of Winsley-street, Oxford-street, Middlesex, engineer, for improvements in the construction of wheels for railway and other carriages. March 25.

Richard Roberts, of Manchester, Lancaster, civil engineer, for an extension of seven years from 5th April, 1839, of a patent granted to him for an improvement or certain improvements of, in, or applicable to the mule billy jenny stretching frame, or any other machine or machines, however designated or named, used in spinning cotton wool or other fibrous substances, and in which either the spindles recede from and approach the rollers or other deliverers of the said fibrous substances, or in which such rollers and deliverers recede from and approach the spindles. March 25.

Andrew Smith, Princes-street, Leicester-square, Middlesex, engineer, for certain improvements in apparatus for heating fluids and generating steam. March 27.

Wilton Wood, of Liverpool, Lancaster, merchant, for improved methods of making bands and tackling to be used in driving, turning, or carrying machinery. March 27.

John Ruthven and Morris West Ruthven, of Edinburgh, civil engineers, for improvements in boilers for generating steam, in economising fuel in propelling vessels by steam or other power, and ventilating vessels, and which may be applied to mines or buildings. March 28.

John Gray, of Liverpool, engineer, for certain improvements in steam engines and apparatus connected therewith, which improvements are particularly applicable to marine engines for propelling boats or vessels, and part or parts of which improvements are also applicable to locomotive and stationary steam engines and other purposes. March 29.

William Hale, of Greenwich, Kent, for improvements in steam engines and apparatus connected therewith, and in machinery for propelling vessels, part of which improvements are applicable to raising or forcing fluids. April 2.

William Henry Porter, of Russia-row, Milk-street, Cheapside, London, warehouseman, for improvements in anchors. April 2.

Thomas Adamson, of Dundee, in the county of Forfar, North Britain, ship-builder, for certain improvements in the machinery employed in turning windlasses. April 2.

Robert Logan, of Trafalgar-square, Middlesex, for a new cloth or cloths constructed from cocoa nut fibre, and certain improvements in preparing such fibrous material for the same and other purposes. April 3.

John Bourne, of the city of Dublin, engineer, for improvements in steam engines, and in the construction of boilers, furnaces, and stoves. April 16.

LIST OF IRISH PATENTS GRANTED IN MARCH, 1839.

Orlando Jones, for improvements in the manufacture of starch, and the converting of the refuse arising in, or from such manufacture to divers useful purposes. March 6.

C. Gabriel, Baron de Suaree, and William Pontifex, for a new mode of obtaining vegetable extracts. March 7.

John Fowler, for certain improvements in preparing or manufacturing sulphuric acid. March 9.

Charles Flude, for improvements in applying heat for smelting or otherwise working ores, metals and earths, and for heating steam boilers, and for general manufacturing or other useful purposes where heat is required; and also for an improved mode of supplying hot water to steam boilers; the said improvements having economy of fuel for their object. March 13.

J. B. Humphreys, for improvements in marine and other steam engines. March 22.

P. A. Lecomte de Fontainemoreau, for certain new and improved metallic alloys, to be used in various cases as substitutes for zinc, cast iron, copper and other metals. March 30.

John Leigh, for an improved mode of obtaining carbonate of lead, commonly called white lead. March 30.

NOTES AND NOTICES.

Rodda's Patent Method of Consuming Smoke.—Amongst the numerous patents which have lately been obtained for plans for consuming smoke, there are none which can vie in simplicity with that invented by a Mr. Rodda; and its efficiency, as far as it has been tried, has been unequivocally attested by the engineer and others who have superintended the operation of the plan at Truman, Hanbury and Co.'s brewery. The method adopted is to partition off a portion of the back of a furnace with fire-brick, so that when the coal has been coked in the fore part, it is thrust into the hinder division, and the smoke from the freshly supplied coal being compelled to pass over the incandescent coked fuel, is consumed. The principal merit of this invention is in its simplicity, consisting merely of a few fire-bricks, which may be placed in any furnace without expensive alteration. We shall hereafter publish a full description and engravings of the plan.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 6, Peterborough-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 821.] SATURDAY, MAY 4, 1839. [Price 3d.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

GOTTLIEB'S, GARNETT'S, SPONG'S, AND BRANDRETH'S PATENT ANTI-ATTRITION AXLES.

Fig. 1.

Fig. 2.

Fig. 3.

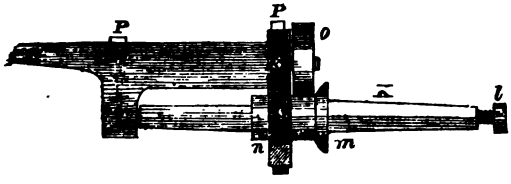
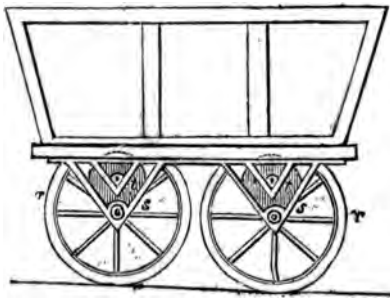


Fig. 4.



ON FRICTION, AND THE EMPLOYMENT OF ANTI-FRICTION ROLLERS—GOTTLIEB'S, GARNETT'S, SPONG'S, COLES'S, BRANDRETH'S, AND HOWARD'S INVENTIONS.

Sir,—The friction ordinarily generated by the moving parts of machinery, opposes so much resistance to the motive power, and is likewise so injurious to the structure of the machine itself, that a practical acquaintance with the nature and effects of this retarding force, and also with the best methods of diminishing its effects, are subjects of the highest importance.

The subject of friction has been examined at considerable length by Amontons, Bulfinger, Parent, Euler, Bossut, Coulomb, Vince, Wood, and several others; but, notwithstanding their investigations, there is scarcely another subject in the range of the physical sciences, upon which there exists so much diversity of opinion, as in the laws which govern friction. Notwithstanding that the accumulated results of numerous judiciously varied and well conducted experiments, have furnished rules sufficiently accurate for many practical purposes, yet they are by no means adequate to bring this inquiry into a thoroughly settled state.

The consequence of the very earliest attention to the subject of friction, was to show the importance of employing a *rolling* in preference to a *sliding* motion, exemplified in the employment of wheel-carriages instead of sledges. Having achieved thus much, it was found that considerable friction arose from the sliding round of the wheel upon the axle-tree; to convert this into a rolling motion, unctuous matters of various kinds were employed, the spherical particles of which were found extremely well adapted to the purpose.

It was, however, attempted to effect the annihilation—or at least the most effectual reduction of the amount—of friction, by purely mechanical means. At a very early period Casatus proposed to diminish the friction of axles by making them rest on the peripheries of other wheels, and by this means to remove and diminish the friction step by step, till it was annihilated. The first practical application of this principle is ascribed to *Sully, who is reported to have introduced friction-wheels into clocks* A.D. 1716; they were certainly applied to cranes in 1725, by Mondran. These solitary attempts to bring friction-wheels into fashion, however, attracted but little notice, until the celebrated Euler examined and explained their nature and peculiar advantages. Even since his time the employment of friction, or more properly speaking, anti-friction wheels, has been exceedingly limited; of their successful introduction instances are far from numerous. Some of the mechanical means that have been resorted to for counteracting the effects of friction are sufficiently curious to merit a slight examination, although many of them afford examples to be avoided rather than copied.

Some few years since, a Mr. Gottlieb took out a patent for an anti-attrition axle-tree; it consisted of a stout roller A, fig. 1, from four to six inches long, running in a square groove cut out for it on the under side of the axle-tree B, which runs in the nave of the wheel C D. Among other objections to this arrangement, it will be observed that Mr. Gottlieb has placed his anti-friction wheels in a wrong position, and that it would be very difficult indeed to place them in a right one; for it must be evident that the point of greatest pressure is continually changing, inclining to the front of the carriage as it is drawn along, in proportion to the load carried and the speed with which it is moved. The weight will never be perpendicular, except when the carriage is at rest. Mr. Garnett, of Bristol, brought out an anti-attrition axle free from the objection urged against Mr. Gottlieb's contrivance. Mr. Garnett leaves a space between the nave of the wheel E F, fig 2, and the axis G, in which he places several anti-friction rollers H H H, nearly in contact with each other. In the accompanying sketch it will be seen that the axis of the rollers H H H work in a metallic ring *i*, of which there is one at either end of the box, kept in their places by bolts passing through the centres of the rollers.

Mr. Spong attempted the construction of an axle-tree in which friction should be reduced to a minimum, in the following manner. In this contrivance the wheel is firmly attached to the axle, which revolves with it. In the sketch, fig. 3, K represents the axle, l is a nut for securing the wheel by screwing it

tight up to the shoulder *m*. This axle revolves in two bearings, viz., in a plummer-block at *n*, capable of adjustment by screws, the other end resting in a solid bearing formed by the peculiar shape given to the axle-tree. In the front end of the axle is placed an anti-friction wheel *o*, pivoted upon the axle-tree. P P are small channels for supplying oil to the bearings.

About four years ago Mr. Brandreth, of Liverpool, took out a patent for the application of anti-friction wheels to railway carriages; in his plan, the ground wheels *r r* (fig. 4), were fixed upon the axles, which ran freely in bushes *s s*, suspended in an angular iron framing. *t t* are anti-friction wheels, which carry all the weight, having a bearing on the axles of the ground wheels. A somewhat similar arrangement, in connexion with other improvements, formed the subject of a patent granted to Mr. Howard, and strange to say, a third patent has recently been *secured* for the very same thing. I allude to that of Mr. Coles: vide *Mechanics' Magazine*, Nos. 773 and 776. Mr. Coles fancied he had distanced all his predecessors, by a multiplication of anti-friction wheels, but his error was that, in which the mechanical writers of the olden time were so wont to revel; they gravely asserted that by employing a sufficient number of wheels and pinions, any weight might be moved, or an oak pulled up by the roots by a thread, or a hair of the head. So Mr. Coles imagined, that by employing a sufficient number of anti-friction wheels, friction would be entirely annihilated, forgetting that every wheel and axle in the series had *some* friction, and that the sum of these added together might exceed the quantity originally sought to be reduced.

Mr. Coles laid great stress upon the lateral friction arising from the curves on railways, a point certainly open to objection in the present mode of constructing railway carriages. However, Mr. Cole's remedy was much worse than the disease, for he proposed to throw all the weight upon two wheels instead of four, and by means of a peculiar kind of coupling, to allow each carriage to accommodate itself to the curvature of the road. *This matter had, however, been much better met, in the patent of Mr. Howard before alluded to: for* in addition to his attempted reduction of friction by the employment of large wheels working over the axles of the ground wheels, Mr. Howard also proposed to diminish the lateral friction arising out of the curved lines of railway. For this purpose, the beds of the fore and hind wheels were connected by a bolt, at a point equidistant from each; a similar connexion is made between the hind bed of one carriage and the front of that which follows it: or the fore bed of the leading waggon with a system of guide wheels, so that the wheels, not only of one waggon, but of the train, will follow each other in the same curve, with no more lateral friction than would be experienced on a straight line of road. This part of Mr. Howard's plan is well deserving the attention of railway engineers*; but with respect to the anti-friction wheels above the ground axles, all inventions seem to have fallen into one common error. This error I have already alluded to while describing Mr. Gottlieb's contrivance, and I had previously pointed it out in some remarks on Mr. Cole's patented contrivances, which appeared at page 179 of your 29th volume.

In all the plans I have enumerated, with the exception of Mr. Garnett's, the anti-friction wheels have been placed perpendicularly over the axles, whereas, the line of friction is always at an angle from the perpendicular, either greater or less, in proportion to the weight carried and the speed of transit. From the result of some recent notable experiments on the Great Western Railway, Dr. Lardner has stated, that with accuracy of mechanical construction, and a good system of lubricature, the friction of the axle in its bearing may be reduced to an exceedingly small amount. The value which he assigned to it was buta small fraction more than *five pounds per ton!*

If by proper care, we can with ordinary means succeed in reducing friction to this small and comparatively unimportant quantity, it would be absurd to encumber a carriage with mechanism that must be worse than useless. It should be borne in mind, that the weight of the carriage must be supported on *some* of the rubbing or sliding parts, and

* A very full account of Mr. Howard's plans may be seen in Hebert's Mechanics' Encyclopedia.

these being already as small as is consistent with the requisite strength, their surfaces cannot be much reduced without running great risk of accident. By means of anti-friction wheels we may *transfer* the friction, but we shall not materially lessen it; while we incur the positive disadvantages of complexity, increased expense, and greater liability to derangement.

In another communication I shall briefly advert to some other applications of anti-friction wheels, and point out the occasional misapplication of this principle in machinery of a stationary character.

I remain, Sir,
Yours respectfully.
WM. BADDELEY.

London, April 2, 1839.

AQUARIUS, *v.* THE LONDON FIRE-BRIGADE.

Sir,—Aquarius has ventured another communication in your last number, which he commences with a song, but he evidently begins to sing very small, and his principal point consists in the perpetration of a wretched *pun*.

Although loth to accept Dr. Johnson's description of a *punster*, yet I cannot help thinking of it, when I observe the want of common honesty which characterises the writings of Aquarius. There is but little in his last effusion that has not been already controverted by the facts and arguments advanced in my former communications; he pertinaciously continues to assert without foundation, and without the semblance of proof, charges of incorrectness* and inconsistency on my part—and of inefficiency—even of intentional and culpable inefficiency on the part of the London Fire-brigade.

Aquarius flounders away in luxurious style, so long as he confines himself to generalities, but whenever he condescends to particulars, he at once exposes, either the grossness of his ignorance, or the perversity and wilfulness of his misrepresentations.

Thus, in his last letter, he says "the chief aim of the fire-offices in everything connected with the brigade, is evidently to make *as great a show as possible* at the lowest possible cost; and in this they are well seconded by Mr. Baddeley, who appears delighted with every matter of *mere display* from the *fancy-ball dresses* of the men, to the gin-shop fronts of the newest stations, in which economy is judiciously combined with parade"!

Now Sir, I apprehend that most of your London readers, at least, must well remember the *showy dresses* of the firemen under the old system; their brummagems of bright blue, of pea-green, and of crimson—their scarlet waistcoats and plush breeches—their massy silver chains and badges, with the profusion of gold lace which added splendour to the habiliments of the foremen, &c., rendering them so highly ornamental in appearance as to be in constant requisition at all our civic processions. Look again, at their gaudily painted engines all redolent of gold and varnish, each bearing the proper insignia of its particular office most elaborately emblazoned with all the skill and powers of heraldic art, and having the title character, and locality of their offices, in staring characters of gold. Even the engine-stations themselves, in several instances partook of the same highly ornamented character. All who remember these, and contrast them with the plain dark grey uniform of the London fire-establishment—*sans* badge—*sans* lace—*sans* everything ornamental, will at once see how extremely unhappy is the allusion of Aquarius. Formerly too, the firemen and engines *did* "make as great a show as possible," by remaining stationed in front of "slightly damaged" buildings for some days; now, on the contrary, the moment a fire is extinguished the engines are returned to their respective stations, in readiness for any further requirements. This is the right method most unquestionably, and it is reasonable enough, because, not bearing the

* Even if I *had* been somewhat incorrect, I think I might have claimed a little indulgence, seeing that the Metropolitan Police, numbering altogether upwards of three thousand four hundred men, are so very wide of the mark in *their fire reports*. In the second number of the Journal of the Statistical Society of London, it was stated in an article upon the Metropolitan Police, that the number of fires observed and reported by that force amounted in 1836 to 240, and in 1837 to 229; whereas, the number of fires actually attended by the London fire-establishment, and enumerated in my annual reports, was just double that amount in both years, exclusive of fires in the City, which, of course, are not taken into account by the metropolitan Police.

title of any particular fire-office, the engines cease to be standing advertisements, even if left standing in the public streets; so that altogether, however justly the remarks of Aquarius might apply to his much-loved-and-never-enough-to-be-admired "old system;" yet, when applied to the present fire-brigade, they are false, and consequently the statement is in the highest degree absurd.

The only peculiarity of the present firemen's dress, is, perhaps, the *morion*, or helmet, and that is not modern—*only resumed*, having been constantly worn by firemen down to a comparatively recent period, when it fell into disuse.

There is one subject upon which I beg to offer a few explanatory remarks, and it is with respect to auxiliaries. Under the "old system," with the larger number of firemen *I have frequently seen engines standing inactive for want of hands to work them;* a circumstance that has never yet occurred to the brigade; they count upon getting their engines manned principally by auxiliaries, whom they always pay and also furnish with refreshments. I happen to know that the expenses of the fire-establishment for the pay and refreshments of auxiliaries, amount upon an average, to upwards of one thousand pounds per annum; and they have paid as much as two hundred and fifty pounds per month. This remuneration is not limited to assistance exclusively rendered to the brigade, Mr. Braidwood is frequently in the habit of paying persons who may have been working parish and private engines, when such have been usefully employed.

I well remember the fire in Bond-street, which destroyed the Western Exchange, and seriously damaged Burlington-arcade; upon that occasion a great number of the foot-guards turned out, some under arms, others in their fatigue dress; the latter by direction of their officers manned the engines of the brigade, which they worked with a spirit I never saw exceeded. After the fire was got under, the bugle sounded for the men to fall in, when Mr. Braidwood stepped up to the commanding officer, and in my hearing expressed his desire to remunerate the soldiers for their exertions, explaining that such was his invariable custom. A pay-serjeant was accordingly called, to whom Mr. Braidwood handed a bank-note with a request that it might be divided among the men on their return to the barracks. Upon this, the officer, addressing himself to Mr. Braidwood, enquired "to what office he belonged?" "To the London Fire Establishment" was the reply; then said the officer, "you belong to a very liberal establishment and we are much obliged to you."

By these means the brigade can always depend upon getting their engines well manned and worked with spirit, and this is part of the secret how, "with somewhat less than one hundred" regular firemen they are enabled to give more prompt and efficient aid in case of fire, than was ever afforded by the old disunited and imperfect—though more numerous band.

The promptness with which strangers flock to the assistance of the brigade, was pleasingly exhibited in a most striking manner a few days since. On the 12th of this month, an alarm of fire at Nicholson's Wharf, London-bridge, was given at the Watling-street station of the London Fire Establishment; a messenger was instantly dispatched to the floating fire-engine moored off Southwark-bridge, an engine from the former station being horsed and sent forward with all possible expedition. They had not, however, proceeded many yards, when they were stopped by the intelligence that it was only a chimney on fire. A stop was directly sent off to the floating engine, when it was found, that although less than five minutes had elapsed from the first sounding of the *alarm-gong, forty-one strangers* had boarded the floating engine, and one of the Greenwich steam-boats had taken it in tow, and was proceeding with it to the scene of danger! Both the steam-boat and the auxiliaries were forthwith discharged, after being paid for their prompt attention. Whatever want of liberality may appear to characterise other proceedings of the London Fire Establishment, it is certain that they always pay, and pay liberally too, for such extraneous assistance as they may require at fires.

The insurance companies having formed a "fire-preventive system" upon a scale which they consider commensurate with the extent of their business, they certainly have endeavoured by every

possible means to give that system the highest degree of efficiency; and although in reality but "a mere handful of men" yet they have achieved triumphs and obtained "that sort of success" that would be creditable to any other body, however numerous or well appointed they might be.

Under our present system of defective buildings and deficient water supply* it is quite certain that serious fires will occasionally—perhaps frequently, occur, even though the firemen should become as numerous, and the engines as powerful, as Aquarius, in his profound ignorance of the subject, would seem to require.

When Aquarius shall, by something like twenty years personal attendance and observations, have become practically acquainted with the details of this subject, he will then probably become qualified to give opinions thereon to which it would be no *disgrace* to put his name, and he will then be entitled to that attention from your readers to which he must feel he has no claim at present.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

London, April 22, 1839.

MOVEABLE CELESTIAL PLANISPHERE.

Sir,—Although your Magazine is intended chiefly for *practical* communications, yet since it is read by many persons for amusement only, I am induced to send the following description of a moveable celestial planisphere which I constructed in the beginning of the year 1837, and which, from its extreme simplicity, may, with a little care, be made by any one in a day or two.

The first part of the instrument consists of a circular piece of *card-board* about one foot in diameter: the centre of it is the north pole of the heavens, round which the equator and the circles of declination are described, as far as the 40th degree of *south* declination: which last circle of declination is about one inch from the margin of the cardboard. On this card-board the ecliptic is drawn and the principal stars laid down; lines of right ascension having been drawn from the pole. Round the pole as centre, a circle is described with a radius about half an inch longer than that of the last circle of declination, and is divided into 365 equal divisions corresponding to the days of the year. The 20th of September nearly coincides with the first point of *Aries*.

The second part of the instrument consists of another circular piece of cardboard, the circumference of which coincides with the circle on which are the days of the year. Out of this is cut an *ellipse*, the axis-minor of which is 180 degrees in length and the centre of which is 39 degrees from the centre of the card-board—a degree being the same in length as that on the map. The axis-major is to the axis-minor as 10 to 9 nearly. On the margin of this ellipse are marked the 32 points of the compass; the north point being at that extremity of the axis-minor which is furthest from the margin of the card-board. The margin of this card-board is divided into 24 equal divisions corresponding to the hours of the day; 12 o'clock at *night* coincides with the south part of the *ellipse*. Of course the succeeding hours, 1, 2, 3, &c., are marked towards the *west*.

The third part of the instrument is a strip of card-board about a quarter of an inch in breadth, and equal in length to the semi-axis-*major* of the *ellipse*. It is graduated from 0 to 90° on one side corresponding to the semi-axis-*major*, and also from 0 to 90° on the other side corresponding to the semi-axis-*minor*; and consequently the divisions on this latter side are less in magnitude.

The fourth and last part of the instrument consists of two strips of wood crossing each other at right angles in the middle. One of the strips of wood is equal in length to the diameter of the *map*, and the other is about an inch longer. The several parts of the instrument having been described, it remains to be shown how they are to be put together. The *map* is fastened to the middle of the crossed pieces of wood by a tack passing through the pole. The other piece of card-board is fastened over the *face* of the *map* to the projecting ends of the longer stick by means of two strips of

* I have just returned from a fire in the Grove, Southwark, at which not a drop of water could be obtained from the Company's mains. However, by dint of great exertions on the part of the firemen, with a limited supply of water which they found upon the premises, they have made another splendid stop.

title of any particular fire-office, the engines cease to be standing advertisements, even if left standing in the public streets; so that altogether, however justly the remarks of Aquarius might apply to his much-loved-and-never-enough-to-be-admired "old system;" yet, when applied to the present fire-brigade, they are false, and consequently the statement is in the highest degree absurd.

The only peculiarity of the present firemen's dress, is, perhaps, the *morion*, or helmet, and that is not modern—*only resumed*, having been constantly worn by firemen down to a comparatively recent period, when it fell into disuse.

There is one subject upon which I beg to offer a few explanatory remarks, and it is with respect to auxiliaries. Under the "old system," with the larger number of firemen *I have frequently seen engines standing inactive for want of hands to work them;* a circumstance that has never yet occurred to the brigade; they count upon getting their engines manned principally by auxiliaries, whom they always pay and also furnish with refreshments. I happen to know that the expenses of the fire-establishment for the pay and refreshments of auxiliaries, amount upon an average, to upwards of one thousand pounds per annum; and they have paid as much as two hundred and fifty pounds per month. This remuneration is not limited to assistance exclusively rendered to the brigade, Mr. Braidwood is frequently in the habit of paying persons who may have been working parish and private engines, when such have been usefully employed.

I well remember the fire in Bond-street, which destroyed the Western Exchange, and seriously damaged Burlington-arcade; upon that occasion a great number of the foot-guards turned out, some under arms, others in their fatigue dress; the latter by direction of their officers manned the engines of the brigade, which they worked with a spirit I never saw exceeded. After the fire was got under, the bugle sounded for the men to fall in, when Mr. Braidwood stepped up to the commanding officer, and in my hearing expressed his desire to remunerate the soldiers for their exertions, explaining that *such was his invariable custom. A pay-serjeant was accordingly* called, to whom Mr. Braidwood handed a bank-note with a request that it might be divided among the men on their return to the barracks. Upon this, the officer, addressing himself to Mr. Braidwood, enquired "to what office he belonged?" "To the London Fire Establishment" was the reply; then said the officer, "you belong to a very liberal establishment and we are much obliged to you."

By these means the brigade can always depend upon getting their engines well manned and worked with spirit, and this is part of the secret how, "with somewhat less than one hundred" regular firemen they are enabled to give more prompt and efficient aid in case of fire, than was ever afforded by the old disunited and imperfect—though more numerous band.

The promptness with which strangers flock to the assistance of the brigade, was pleasingly exhibited in a most striking manner a few days since. On the 12th of this month, an alarm of fire at Nicholson's Wharf, London-bridge, was given at the Watling-street station of the London Fire Establishment; a messenger was instantly dispatched to the floating fire-engine moored off Southwark-bridge, an engine from the former station being horsed and sent forward with all possible expedition. They had not, however, proceeded many yards, when they were stopped by the intelligence that it was only a chimney on fire. A stop was directly sent off to the floating engine, when it was found, that although less than five minutes had elapsed from the first sounding of the *alarm-gong, forty-one strangers* had boarded the floating engine, and one of the Greenwich steam-boats had taken it in tow, and was proceeding with it to the scene of danger! Both the steam-boat and the auxiliaries were forthwith discharged, after being paid for their prompt attention. Whatever want of liberality may appear to characterise other proceedings of the London Fire Establishment, it is certain that they always pay, and pay liberally too, for such extraneous assistance as they may require at fires.

The insurance companies having formed a "fire-preventive system" upon a scale which they consider commensurate with the extent of their business, they certainly have endeavoured by every

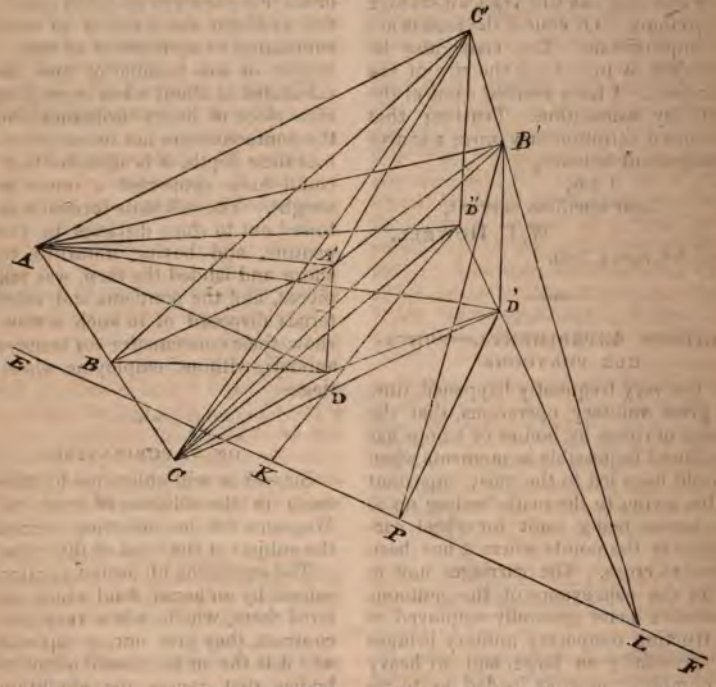
vessel of cold water, either from the spring or of water which has been previously boiled, deep enough to allow a common drinking glass to be inverted in it without admitting the air into the interior of the glass, then raise the inverted glass a little from the bottom of the vessel, and thrust a piece of red-hot iron, stone, brick, or cinder under it, and the air from the heated substance will rise into the glass and be retained. It is not evanescent vapour. It may be retained for any length of time.

These experiments are made without either trouble or expense, and they prove beyond all doubt, that an aerial fluid issues copiously out of highly heated substances, which sufficiently accounts for their expansion, and is, no doubt, the cause of their repulsion. It is impossible such a fluid should be squeezed out of them without causing more or less of repulsion. And it is submitted that these experiments are equally decisive as to the nature of the vapour of water, as it is called, and prove that it is not any formation from the water, but that it is an aerial fluid which penetrates and comes through the vessel in which the water boils.

Remaining, Sir, with much respect,

W.

SOLUTION OF QUESTION IN TRIANGULATION.



Sir,—I send you a solution of Mr. Jones's interesting question on the subject of triangulation—which I hope you will be so good to insert.

I am,

Sir, yours, &c.,

J. NELSON.

Paddington-street, April 13, 1839.

Let A, B, and C represent the three stations; A′, B′, C′ the positions of the three objects to be observed; D, D′, D″ three points diametrically under the points A′, B′, C′, and in the same plane with the station line AB. Join AD, AA′, BD, BA′, CD, CA′, &c., as in the figure.

Assume AB=a, BC=b and let the

three angles of elevation of the first object A′, as seen from A, B, and C be represented by D, E, F, and the perpendicular height of the object A′, be h then from a well known trigonometrical theorum $h=$

$$\sqrt{\frac{(a+b)ab}{b.\ \text{Cot.}^2 D + a.\ \text{Cot.}^2 F - (a+b).\ \text{Cot.}^2 E}} =$$

$$\sqrt{\frac{155\times 80\times 75}{75.\ \text{Cot.}^2 67^\circ 10' + 80\ \text{Cot.}^2 52^\circ 18' - 155.\ \text{Cot.}^2 68^\circ 15'}} = 159.83 \text{ yards} =$$

479.49 feet.

In the same way the heights of the objects B′ and C′ are found to be 859.218 and 970.16 feet respectively.

2nd. To find A A′ and A D:—

Cosect....	67.10	0.075991	Cot.....	9.624330
A′D.....	479.49	2.680780	A′D.....	2.680780
AA′.....	571.18	2.756771	A D 210.88..	2.305110

In the same way A B′, A C′, B A′, B B′, B C′, C A′, C B′, C C′ will be 901.91, 1119.31, 516.24, 877.6, 1107.45, 606.01, 913.39, 1142.95. and A D′, A D″, B D, B D′, B D″, C D, C D′, C D″, are 274.21, 558.24, 191.29, 178.71, 534.08, 370.59 309.90, 604.26.

3rd. To find the distance D D′, between the bottoms of the two first objects. 1st. In the triangle D A C are given all the sides the angle D A C will be 50° 25′ 17″. 2nd. In the triangle D′ A C are given all the sides the angle D′ A C will be 39°.59′.28″. ∴ the angle D A D′=10° 25′ 49″. 3rd. In the triangle D A D′ we have two sides and the included angle: D D′ will be found to be 84.00. In the same way D′ D″, D D″ will be found to be 355.61 and 377.12 respectively.

4th. To find the distance between the tops of the first and third: 970.16—479.49= 490.67. ∴ A′ C′= $\sqrt{(490.67)^2+(377.12)^2}$ = $\sqrt{382976.5433}$=618.85 feet. In the same way the distance between the tops of the first and second and the second and third will be 388.91 and 372.51 feet respectively.

Let the straight line E F be the common section of the plane passing through the points A′, B′, C′, and the plane of the horizon and D″ D and D″ D meet the common section in the points L and K. Draw D′ P perpendicular and join P B, then shall the angle B′ P D′ be the inclination of the two required planes.

5th. To find K D″. As 490.67 : 377.12 :: 970.16 : 745.65 = K D″. In the same way L D″ will be found to be 3109.77. ∴ D′ L=2754.18.

Lastly. To find the angle of inclination between the horizontal plane and the plane passing through the three points A′, B′, C′.

In the triangle D D′ D″ are given all the sides the angle D D″ D′ will be 12° 46′ 5″.

In the triangle K D″ L are given two sides and the contained angle, the angle K L D″ will be 3° 57′ 29″.

In the right angled triangle D′ P L are given all the angles and one side. D′ P will be found to be 190.24.

In the right angled triangle P D′ B′ are given two sides and the contained angle, the angle B′ P D′ will be 77° 32′ 36″.

J. N.

[A very correct and clever solution. It is due to the author to mention that he is not yet 13 years of age.—Ed. M. M.]

COMPRESSED AIR MINING LAMP—CLAIM TO ITS INVENTION BY BARON WETTERSTEDT.

Sir,—Having seen published in the *Mechanics' Magazine* of this day, a description of a mining lamp, deriving its supply of air from a reservoir, in order to aliment the flame of the light, without immediate communication with the exterior air, I must *for my own reputation make it public, that two years ago I made this discovery, and during a journey* in April last year, to Newcastle, North and South Shields, &c., communicated and exhibited this plan at some coal mines, which is well known. But as I have experienced that this safety lamp is not easily transportable in the long and narrow galleries of coal mines; besides by the usual generation during combustion of carbonic gas and the large portion

of azote accumulating in the interior of the lamp, which cannot be well expelled, even notwithstanding I used lime to absorb the carbonic gas, the flame was often liable to burn dim, or to go out: and, moreover, every cubic foot of atmospheric air is only sufficient for maintaining the flame of a small wick, from 270 seconds to five minutes. These reasons against the practical use of the lamp made me relinquish further experiments, which were pretty expensive and numerous. I suggested, by means of air-pressing machines in convenient places, and by lead or iron pipes, or by pipes made of my totally imperishable patent marine metal, to introduce in cylinders like those in gas works, atmospheric air, for supplying several of these lamps, or for ventilation; but have not further proceeded: besides, the safety lamp of the late immortal Sir Humphrey Davy is pretty secure. I shall soon communicate to the public a practical and further security against accidents by the ignition of the foul air.

BARON CHARLES WETTERSTEDT,
F.R.S.S.A., F.A.L., C.F., &c.

Limehouse, April 20, 1839.

MECHANICAL PROBABILITIES.

* * * * *

"To try, by way of experiment, whether
They couldn't be made of wood and leather.

* * * * *

Which, wound up carefully once a week,
Might just like parsons look and speak.

* * * * *

The patentees of this new invention
Beg leave respectfully to mention,
They now are enabled to produce
A large supply, for present use,
Of these reverend pieces of machinery,
Ready for vicarage, rect'ry, deanery,
Or any such like post of skill
That wood and leather are fit to fill."

Sir,—Moore, from one of whose poetical squibs the above fragments are extracted, has often been convicted of plagiarism. I need scarcely remind you of the unanswerable proofs, brought forward by Doctor Maginn, of most of the Irish Melodies being merely clever translations from the celebrated Father Prout.

In the *Mechanics' Magazine* of the 20th instant, I perceive another proof of the great poet's literary peculation, furnished by your witty and learned correspondent Charles Thornton Coathupe.

The *poetical* squib bears such an extraordinary resemblance to the *prosy* one, that both, evidently, cannot be original. It must, therefore, be quite clear that Mr. Moore roguishly put your correspondent's talented effusion into rhyme, by anticipation, some five or six years since.

I am, Sir,
Your obedient servant,
VIRGIDEMIA.

April 26, 1839.

SIMULTANEOUS LIGHTING OF GAS-LAMPS.

Sir,—A perusal of the ingenious plan of your correspondent Mr. Joseph Beck, at page 407, vol. xxx, has recalled to my mind a suggestion of my own made many years since, with a view to effect the simultaneous lighting of street gas lamps throughout a town or district. As an object of occasional relaxation, I have long been accustomed, by means of a private press, to render tangible memoranda of this kind as they occur, in a printed form, and as I find the suggestion alluded to in that shape, I beg to submit it to your notice, to the end that, should you deem it worth preservation in a more extended medium, it may be wholly at your service.

I am, Sir,
Very truly yours,
W. H. WEEKES.

Sandwich, 5th April, 1839.

One of the most interesting facts as connected with the recent advancement of modern chemical science, perhaps, is the important discovery of that intelligent continental philosopher Dobereiner, who has ascertained the peculiar property of *spongy platinum* to become ignited by exposure to the action of a stream of hydrogen gas, and the consequent inflammation of the gas itself, from contact with the ignited metal; thus furnishing a most ingenious, elegant and useful mode of obtaining instantaneous light. When either ammonia, or its salts be added to a concentrated solution of platinum in what is usually denominated *aqua regia*, or nitro-muriatic acid, a precipitate is formed, consisting of one equivalent of the bichloride, and one of muriate of ammonia, and when this compound is heated to redness, the chlorine and muriate of ammonia are evolved, and pure platinum remains in the form of a delicate spongy mass. Now, will similar results obtain from the action of spongy platinum on the gaseous

compound *carburetted hydrogen* or coal gas?* Of this I think there can be little doubt, and if proved, the *spongy platinum* may unquestionably be rendered applicable to the purpose of lighting street lamps spontaneously. A very little exercise of ingenuity would enable us to fix a small mass of the prepared metal in a situation immediately over the gas burner, and we would suggest its temporary retention in that position, by means of a helix or spring, which—availing ourselves of the expansion caused by the heat of the burning gas—might easily be in such-wise contrived, as to recede from the burner after the gas had been turned on from the manufactory, and ignited in the respective lamps. When the supply of gas were turned off, the spring would necessarily contract and replace the metal ready for lighting again the following evening. *Thus might a whole town be simultaneously illuminated with gas, independent of any manual operation.—January* 24, 1826.

PROBABLE EFFECT OF THE PENNY POSTAGE ON PERIODICAL LITERATURE.

We extract the following sensible and forcible remarks on the probable influence of Mr. Hill's plan of a uniform penny postage, from a letter by Mr. Loudon, the Editor of the *Gardener's Magazine* and numerous other works on the useful arts, addressed to the Editor of the *Morning Chronicle*. The application of the various arguments is equally pertinent with regard to the Mechanics, as to the Gardeners of the nation; and were we inclined to plagiarism, by the mere substitution of the one word for the other, we should find in the words of our intelligent cotemporary, a cogent leader cut and dry to our hand.

"I have founded and edited three magazines; but I shall confine myself here to that which has been longest in existence, viz., the *Gardener's Magazine*. I shall consider the penny postage, first, as it will affect the *Gardener's Magazine* as a source of revenue to the Government; and secondly, as it will affect it as a record of horticultural science, and as a means of the improvement of gardeners. I may previously observe, that what I shall have to state respecting the *Gardener's Magazine*, of which I am proprietor and editor, will necessarily apply in a great measure to the other horticultural magazines, of which there are five or six; to the different agricultural journals and magazines, and to that extensively-circulated and very useful journal, the *Mechanics' Magazine*. To these I might perhaps add the *Gentleman's Magazine* (as it has many country correspondents), and one or two others; but such magazines as *Blackwood's*, the *New Monthly*, *Bentley's* &c., being supported by a few contributors, who reside for the most part in London or Edinburgh, can be comparatively little affected by postage.

"1. *A Penny Postage as it would affect the Gardener's Magazine as a source of revenue to the State.*—The *Gardener's Magazine* was commenced in the end of the year 1824, and was published at first quarterly, and subsequently, as at the present time, monthly. The contributors to it are, for the most part, master gardeners whose incomes vary from 50*l.* to 100*l.* a year, with a house rent-free, &c., and journeymen gardeners, whose wages vary in different parts of the country from 9s. to 12s. a week. As is usual in the case of periodicals, all letters addressed to the editor are required to be post-paid; and it may easily be conceived, that this condition will be felt as a heavy tax on persons whose incomes are such as I have mentioned. The whole of the letters received on account of the *Gardener's Magazine* have been registered; and the number, taking the average of the fourteen years which have elapsed since it was commenced, including sending out and receiving back proof sheets, amounts to nearly a thousand letters a year. Considering that a great part of these letters are from Scotland, and many from Ireland, 8d. a letter will probably be the average sum paid by the writers. Now the question is, whether, if the postage were reduced to a penny a letter, I should not receive eight letters from gardeners for one which I do at present? Knowing the great desire which gardeners have to improve themselves, the ambition of young men to appear in print, the superior situation, as head gardener or foreman, which a reading and writing gardener can always command, and the consequently great increase of reading and writing gardeners since the *Gardener's Magazine* was commenced, I think it highly probable that my correspondence on account of that work would be increased more than eight-fold. It must be considered also, that my answers to letters received would increase in the same proportion; and I find that, on an average, one communication in four, which I receive for the *Gardener's Magazine*, requires a private letter on my part to the contributor, or a proof sheet to be sent to him; so that I should think a ten-fold increase in the number

* *Subsequent experience has confirmed this expectation.*

of letters on the ordinary business of the magazine might be calculated on, without reference to any new scheme on my part. But if the postage were reduced to a penny a letter, I should, by writing to different individuals in every county in Great Britain and Ireland, endeavour to procure a list of all the principal gardeners in the empire, with a view to writing to them for particular kinds of information whenever I found it necessary or advantageous. For example, in the spring of 1838, I wrote to twenty or thirty individuals in different parts of the empire, to know the effects of the past severe winter on certain kinds of trees and shrubs, with the view of ascertaining their comoarative hardiness and the answers for the most part have appeared in my magazine; but had I been able to send letters at the rate of a penny each, and had I possessed such a list as that which I allude to, I should probably have issued one thousand letters, and have received at least half as many answers; and, of course, I should have attained more effectually the object I had in view. I could also in the same manner distribute seeds sometimes sent to me from abroad, but which at present I cannot send to persons at a distance without franks. Not to go further into detail, I think I have shown that the reduction of the postage to a penny a letter, would occasion so great an increase in the number of letters received and sent out on account of the *Gardener's Magazine*, as amply to make up for the reduced charge.

"2. *How far a Penny Postage will affect garden periodical literature, as a record of horticultural improvement, and as a source of scientific and moral improvement to gardeners.*—It will readily be conceived that persons with the low incomes of gardeners, whether journeymen or masters, are often deterred from sending communications to periodicals from the expense of postage as at present regulated; and hence, that many facts which would contribute to the progress of science are lost from not being recorded. A single new fact put on record by one individual, not only is a gain to science in itself, but it often elicits other facts of a similar, or of an opposite kind from other individuals, and thus, from the very slightest beginnings, the most important series of facts and discussions on them often arise. Thus far as to the progress of science. The improvement of gardeners which results from their being induced to write, many persons will be able to judge of from their own experience. With persons of ordinary education, the first attempt to write for the press *is most commonly the first attempt* to think *correctly and argue logically*; and in this way putting his thoughts in writing seldom fails to give a great impulse to the improvement of the individual. This improvement is greatly accelerated by the discussion, and even controversy, when properly conducted, and which it is the peculiar feature of a Magazine to admit, whenever the object of the writers appears to be truth.

"The moral improvement of gardeners who contribute to periodicals is a certain consequence of their scientific improvement, and even of acquiring a taste for reading. The latter occupies those leisure hours which might otherwise be spent in idleness or frivolity; and their scientific knowledge affords them interesting matter for reflection while they are at work. Every implement that a scientific gardener handles, every operation which he performs, every plant that he cultivates, and every weed which he destroys, become invested with a degree of interest proportionate to the knowledge which he has acquired of mechanics, chemistry, and systematic and physiological botany. Those persons who from their practical knowledge can compare the best gardeners of the present day with the best gardeners of twenty years ago, will bear witness to the general truth of what I state; but they cannot feel it with the same force as those who have carefully watched, as I have done, the progress which gardeners have made in writing and thinking since the commencement of the present century, and which I believe it will be generally acknowledged is greatly owing the inducements to self-education held out in the first edition of the *Encyclopædia of Gardening*, in 1821, and to the facility of writing and publishing their opinions, afforded by the establishment of the *Gardener's Magazine* in 1824. I conclude, therefore, that a penny postage, by greatly increasing the number of correspondents to gardening periodicals, would advance science by increasing the number of recorded facts, and by multiplying the number of scientific observers, and that it would improve the morals of the same persons by enhancing their literary enjoyments, and particularly those of their leisure hours."

We may add, with regard to our own particular case, that as the weight of our weekly number would be within that contemplated to be the limit of a single letter, we should be enabled to circulate an immense number by post, in like manner as newspapers are now disseminated. Thus by means of our Magazine information upon the subject of new and important inventions and discoveries could be published amongst particular classes interested, at a very trifling ex-

pense, and from doing which we are now precluded; the Lords of the Treasury having decided that the *Mechanics' Magazine* cannot be stamped as a newspaper for the purpose of circulation by post, while they with great *impartiality* allow this privilege to the *Athenæum*, the *Literary Gazette*, and other contemporaries of a similar character.

WHITELAW'S IMPROVED ROTARY WATER MILL.

We had the pleasure, a few days ago, of witnessing in motion, an improved water mill, which is destined, we think, to work a great and valuable revolution, in the mode of applying hydraulic power. We shall endeavour to give our readers some idea of it, and of the advantages it possesses over the methods heretofore in use. The main principle is the same as is applied in Barker's mill, but so much modified and improved, as to convert, what was little more than a toy, to a most efficient source of motive power.

The purpose to which this mill is to be applied is to drive a powerful water press, and what is termed a Pressing machine. The machinery for setting this in motion, was not in readiness when we witnessed the trial, but to show its power, a friction pulley was placed on the shaft, and a weight of 70 lb. at the end of a lever of 2 feet 11 inches, was applied. With this friction, the machine made 100 revolutions in a minute, and in that time required 70 cubic feet of water. It is allowed that in an ordinary water wheel, about one-third of the power is lost by friction; and otherwise, not to speak of the power lost in bringing up the necessary speed, but with this mill the power produced was equal to about nine-tenths of the weight of the whole column of water; thus losing only a tenth of the power, or perhaps not so much. The advantages of this mill over the water-wheel are almost incalculable. In the first place, the cost is a mere trifle when compared with the cost of a water-wheel. For example, a new cotton mill is about to be erected on the Shaw's water at Greenock, of about 64 feet in diameter, and of a hundred horse power. We are informed that this wheel will cost between four and five thousand pounds; whereas, a mill of the construction we are now speaking of, capable of giving 20 per cent. more power, would probably not cost more than 700*l.* or 800*l.*, while not a fourth of the room would be required, and from the simplicity of the new mill, probably not a tenth of the expense would be necessary to keep it in repair. The Shaw's Water Company have, we are told, a fall at command of 400 feet; and this, if brought down in pipes, might be concentrated at any point on a level with the town, and produce 900 horse-power, or if so much at one point were unnecessary, it could be ramified to any extent required, and still produce in the aggregate that amount of power, without loss. The advantages of bringing the water down to do its work in the most convenient spot, instead of erecting mills away up the stream, are abundantly apparent, and need not be dwelt upon at any length. Another important advantage which this new mill possesses, is this. If the *fall* of the water is very great, and the *quantity* but small, the erection of a water wheel to take advantage of such circumstances might be wholly impracticable, but by this new mill the whole benefits of the height would be fully reaped to the greatest possible advantage. There are many valuable water-falls in the County, to which it would be nearly, if not wholly, impracticable, to carry up buildings to reap the benefit; but by this means, the water, without losing the power, can be carried in pipes to any point, which may be otherwise most advantageous.

In breweries, distilleries, dye-works, &c., where a supply of water is taken from Water Companies; if the quantity be anything considerable, it may, by this mill, be made to exert all its power in moving machinery over and above the direct purposes for which it is taken in.

The inventor of this mill is Mr. James Whitelaw, an ingenious mechanic of Glasgow. The subject has engaged more or less of his attention for several years.

Whether in applying this mill to purposes where a very high degree of power is necessary, any antagonist principle may be brought into operation to retard speed or diminish power, we cannot say. The inventor anticipates no such obstruction; but, of course, it will be prudent to have the invention fairly tested with moderate degrees of power before it is applied on a very large scale.

Whether, however, the mill may be susceptible of very high degrees of power or not, it will at any rate be applicable in a very great variety of cases, and an immense force of water power at present inaccesssible or unavailable, will, we doubt not, be brought into active and useful operation.

We understand a patent is about to be taken out for this invention, when a full and scientific description will doubtless be submitted to public consideration.—*Paisley Advertiser.*

THE RUSSIAN STEAMER NICOLAI.

On Wednesday last, the Lubec and St. Petersburgh Steam Company's new steam ship, the *Nicolai*, propelled by Messrs. Seward and Co.'s improved steam engines, (similar to those of the *Gorgon* frigate), performed an experimental trip to Gravesend and back, having on board a large party of gentlemen engaged in, and connected with, Russian commerce, and interested in steam navigation generally. She slipt her moorings off the east end of the city canal, about twelve o'clock. The smoothness and regularity of the working of the engines was remarkable. In the saloon of the vessel not the slightest vibration was perceptible. The engines, in addition to the improvement of dispensing with the sway-beams, &c., were fitted with Mr. John Seaward's patent water heaters—an apparatus by which the heat of the spent steam is given off to the water feeding the boiler, whereby a considerable saving is effected. The boiler had also fitted to it Mr. Samuel Seaward's improved means of indicating the arrival of the water at that degree of saturation with salt, when it is expedient that the operation of "blowing out" should be performed. This plan consists in an ingenious application of the well known specific gravity balls to the purpose. A glass tube, similar to the water gauge, is attached to the boiler; in this tube are two balls, graduated so that while the water in the boiler remains in a state sufficiently fresh to be used without injury to the boiler, the one swims at the top, and the other is sunk at the bottom. As soon as the water becomes of a certain degree of saturation, desired not to be exceeded, the lower ball will be buoyed up; and both balls being seen at the top of the tube, the engineer knows that the operation of "blowing out" is to be performed. The balls may be graduated to the greatest nicety, indicating the most minute degrees of saturation of the water. There is also an improvement in the mode of "blowing out," rendering the operation one of greater certainty and simplicity. In the fresh-water voyage to Gravesend, the practical working of the salt water balls could not of course be exhibited, but their action was very clearly demonstrated in a number of jugs of water of different degrees of saltness, in which the balls sank or floated according as they had been graduated. The present trial of the *Nicolai* was not for the purpose of ascertaining her speed; being built for freight rather than for passengers, and being unloaded, the paddles little more than tipped the surface of the water. The experiment was considered by all on board to be highly satisfactory. She returned to London about five o'clock, having been detained some time in offering to tow up the *Sirius* (of Atlantic celebrity) destined for the same station, and which it was thought had broken down. The *Nicolai* will leave London for St. Petersburgh next week, and is expected to arrive at her destination in time to take advantage of the opening of the Russian navigation.

TENUITY OF VARIOUS SUBSTANCES.

Tenuity of Fibres of Silk.—The thread of the silk-worm is a perfectly smooth cylinder, whose diameter is from the one thousand seven hundredth to the two thousandth part of an inch.

The Tenuity of Fibres of Wool.—Each hair of wool is a cylinder of from the seven hundredth to the two thousandth part of an inch in thickness, covered with what appear to be overlapping scales, which are laid in the direction in which the hair grows, and the roughness of which we feel when we draw our fingers along it in the opposite direction.

The Fibre of Cotton.—Under the microscope, each fibre of cotton-wool appears to be composed of two tubular cylinders, at a slight distance from one another, but joined together by a membrane. Its section is somewhat in the form of the figure 8. It is about the thousandth part of an inch in diameter.

The Fibre of Flax.—Each fibre of flax is a fasciculus of other fibres, which appear under the microscope jointed and irregular. Some of these have been ascertained to be the two thousand five hundredth part of an inch in diameter. The appearance of the fibre of flax under the microscope is very different from that of cotton. It is by this difference that the fine cere-cloths of the mummies have been determined, by Mr. Bauer, not to be of cotton fabric, but of linen.

Fibres of the Pine Apple Plant.—Some of these have been measured, and are ascertained to be from the five thousandth to the seven thousandth of an inch in diameter. They are perfectly cylindrical, and when twisted into threads and woven, are said to form cloths of a very beautiful texture, and to offer a useful substitute for silk.

Tenuity of the Fibres of a Spider's Thread.—The most remarkable example of the tenuity of a natural fibre is, however, to be sought in the spider's thread, of which two drachms weight would, it is said, reach from London to Edinburgh.

It appears from the observations of Reaumur, that the thread of the spider results from the expulsion of a peculiar viscid matter through six teats under the animal's belly, each of which, being pierced by certain minute apertures, not less, probably, than one thousand in number, yields by each of these a separate fibre, which fibres, uniting with one another from each teat and adhering—and sometimes the compound threads from different teats thus uniting—form those threads which we see composing the web. Now the head of each teat is so small as scarcely to be visible. What then must be the tenuity of the component fibres of the spider's thread, of which more than 1000 spring from the head of each teat?

It is by reason of the exceeding fineness of many natural threads, that they are made to minister so greatly to the luxury of life under those forms of woven tissues, for which the weavers of India were formerly, and our own manufacturers have been of late, so celebrated.

Tenuity of Cotton Yarn.—There is a specimen of Dacca muslin in the museum of the India House, of which the yarn, spun by the hand, was ascertained by Sir J. Banks to be so fine, that a weight of it equal to one pound avoirdupois would extend 115 miles, 2 furlongs, 60 yards. When the muslin made from this Dacca yarn is laid on the grass, and the dew falls upon it, it is said to *be no longer visible.* The natives, in their metaphorical language, call it *woven air.*

Cotton yarn has been spun by machinery in England, of which one pound would extend 167 miles; but this has never been woven.

There are various methods of drawing artificial threads and wires to an extreme tenuity.

Threads of Glass.—Glass is artificially drawn out almost to the fineness of the fibre of silk. A rod of glass is melted in the middle, in the flame of a blowpipe. One portion is then fastened to a small wheel, which being turned rapidly round, the melted glass is drawn out from the other part of the rod which is still held in the flame. Glass *tube* has been thus drawn out to the fineness of silk, *and liquids have afterwards been made to pass through it.* It is a remarkable fact, that whatever was the form of the bore of the original tube, the same form is retained in the *drawn* tube, however great may be its tenuity.

Platinum Wire.—Wires are used in the arts as fine almost as hairs. There is, however, a mechanical limit fixed to the thinness to which *a wire can be drawn,* by the *force necessary to draw it; which force,* when the wire becomes thin, breaks it. This limit has, however, been greatly passed by a method of art, of which the following is an illustration. Wishing to obtain a wire of extreme tenuity to be used in a micrometer, Dr. Wollaston placed a platinum wire one hundredth of an inch in diameter, in the axis of a cylindrical mould one-fifth of an inch in diameter, and cast round it a cylinder of silver. This cylinder he then drew out by the common method, until it became a wire so thin that it would no longer sustain the force necessary to draw it. This wire of silver, along the axis of which ran a wire of platinum, he then immersed in boiling nitric acid, by which the silver was dissolved, and a platinum wire was separated, the *three millionth* of an inch in diameter; being an artificial thread of which 140 must be placed together to equal in thickness a fibre of the finest silk.—*Professor Moseley's Illustration of Mechanics.*

NOTES AND NOTICES.

Whitelaw's Rotary Mill.—We understand that the new Rotary Water Mill, at Mr. Stirrat's field, Nethercraigs, which we noticed in our last, has this week been set a going, with the machinery attached to it, which it is in the mean time intended to drive, and we are happy to learn that it has exceeded the utmost expectations of its most sanguine admirers. Messrs. Donald and Craig, engineers of this town, who are fitting up the machinery attached to the mill, have had occasion to fit up several water wheels of the same calculated power, and they are decidedly of opinion that from none of them could the same actual power be obtained by 30 per cent.—*Paisley Advertiser.*

Spots on the Sun.—Three clusters of spots are now traversing the left side of the face of the sun; two of which are particularly large, the nuclei in each spot being vividly distinct. The whole may be seen with any kind of pocket telescope or spy glass, the eye being protected by a piece of black glass.—*Times.*

The Archimedes Steamer.—On Wednesday last, this steam vessel, fitted with a propeller consisting of a screw placed at the stern (patented by a Mr. Smith), made a short experimental trip. Her performance exceeded the expectations of those who have hitherto expressed opinions unfavourable to the plan. There is one advantage which she certainly possesses over paddle-wheel vessels, which is, the small space in which she turns. Sir John Rennie, who, we understand, is interested in the invention, was on board.

The Nelson Testimonial—The Material.—There are many remarks suggested by an examination of the designs which we should be glad to make at this moment, in the hope that they might have influence with some of the artists engaged, but must at present restrict ourselves briefly to allude to two, namely, the materials of which the testimonial should be composed. * * * It has been shown several times, and successfully, that bronze, enduring as it may be, is hardly to be trusted to as a means of communication with posterity; its intrinsic value and easy convertibility rendering it liable

to destruction in the event of any foreign invasion or domestic disturbance (this is proved by the fewness of the ancient specimens which have been preserved); and therefore, although, thank God! we may believe it is not likely either of those troubles will come upon us, yet it would not be advisable to increase the risk of the destruction of the monument by the use of metal even for the figures. Marble again, which in the glittering atmosphere of Italy is semi-lucent, and long retains its appearance and compactness, in England seldom appears beautiful when exposed to the air, and speedily disintegrates; so that it appears to us we shall do well in this case to resort to some one of the beautiful building stones of our own island, and of that to construct at all events the building and adornments, if not the figures themselves, composing the testimonial, which being protected might then be sculptured in marble.—[From the *Art-Union*, a new periodical devoted to the Fine Arts, the most prominent feature and *fault* of which is, that it never notices a work but to commend. In addition to the above suggestions we would beg to call the attention of artists to a new alloy of metal, which appears to us admirably suited for casting works of art. The alloy is principally composed of zinc, which from its cheapness would not hold out sufficient temptation to depredators, and which may be made the colour of bronze, either the Florentine or antique. This alloy has been lately patented in Great Britain, and we hope shortly to be at liberty to give our readers further particulars of its composition.—Ed. M. M.]

Wooden Pavement in the City.—Last week in the Committee of Sewers, at Guildhall, it was determined to try the experiment of a wooden pavement in the carriage-way opposite to the Central Criminal Court. It is expected that the wood will effectually prevent interruption in the court from the noise of carts and carriages, as well as be incomparably cheaper. There are to be two patterns laid down; the one the patent of Mr. Stead, whose wooden pavement, in Oxford-street, has been so highly commended; the other the patent of Mr. Geary, who a short time ago petitioned the Court of Common Council on the subject, and offered, if his experiment did not satisfy the corporation, to remove it, and substitute the stone pavement, without making any charge. The contractors will commence operations in the street in six weeks, and will complete the pavement in 16 hours; so that there will be no interruption to the traffic through the street. It was stated, on the occasion of the meeting of the commissioners, that Colonel Wilson, the engineer to the Emperor of Russia, said that the wooden pavement in Oxford-street was superior to that used in the capital of the Emperor's dominions. It is believed that the wooden pavement will be soon laid down in the vicinity of the City churches, and two eminent engineers have received instructions to inquire whether the wooden pavement is likely to answer inclined planes as well as on levels. From this fact we calculate that it may be the intention of Mr. Prior, the chairman of Blackfriars-bridge, who is anxious to make the improvements in that edifice as great as possible, to lay down a pavement of the most approved kind. The patentees of the two patterns of wooden pavements stated that the cleanliness of the new plans would strike the public as remarkable, and Mr. Stead declared that the dirt which appeared upon his portion of pavement in Oxford-street, was occasioned by the accumulation from the neighbouring stone pavement which had been laid down in competition.

Electric Spark.—M. Edmund Becquerel has been making experiments on the calorific radiation of the electric spark, and comes to the following conclusions: whether this spark proceeds from a battery or not, there is no elevation of temperature, let the distance be what it will; but as the electric spark excites or revives the phosphorescence of a body gifted with this quality, it is reasonable to suppose, that it affects it by some peculiar radiation, differing from that which produces the sensation of heat.

May-bugs.—An Agriculturist of the department of La Seine-Inferieure has discovered a novel method of destroying May-bugs. He procured a couple of the birds called Kulkimanore from the Sandwich Islands, and taught them to eat these insects. During the season he lets them loose at night, and they return in the morning, after having, according to his calculation, destroyed at least four thousand. These birds have bred under his care, and he has now one hundred couples. It is really a question worth consideration whether this idea might not be followed up to some useful purpose. We have now acquired a mastery over the most savage animals and made them subservient to command—we have taught canaries to talk—dogs to dance—pigs to spell—why not, like the French farmer, endeavour to exercise this power to some profitable end? In Malta, small birds are kept to free the houses of the intolerable pest of flies during the summer season; and by their diligence and activity they are pretty successful, affording no little amusement to the frequenters of some of the crowded cafes, by the capers they cut in pursuit of their prey. They are ensnared for this purpose by the bird-catchers, and after having had a wing cut, are let loose about the house, when they soon become tame; but, as they do not live long in this ensnared state, a frequent supply of fresh birds is required.

Manufactures for Military Purposes in Egypt.—There is a large factory at Damanhur, where woollen cloths and cloaks of coarse quality are made for the use of the army; though indifferent in texture, they wear well. The quantity manufactured, one year with another, may be estimated at 150,000 yards. One general remark applies to Egyptian wool: it is not at all adapted for the finer descriptions of cloth, being full of saltpetre dust, which renders it hard and clotted; so much so indeed, that it loses above two-thirds in cleansing and other preparations for the spindle. The manufacture of saltpetre has been introduced of late years, and is become a source of considerable emolument to the treasury. It was first set on foot by Laffi, a Roman chemist, in the year 1834, and it would be difficult to point out any climate possessing such pre-eminent advantages for such a branch of industry, as that of Egypt, from its extreme purity, no less than from its containing an exhaustless mine of material in the deposit of saline stilth, which is found in so extensive a portion of the surface of the country. The system set on foot by Laffi has been adopted in the saltpetre works established at Hermopolis, Old Cairo, the vicinity of Sakkarah, and in several other places. They consist of receivers of brick, placed in [illegible] down the side of acclivities; the soil suited to the purpose is deposited in the first row of receivers, water is then let in upon it, and the mass is set in agitation; thence it descends, carrying the saltpetre with which it is impregnated, along with it from row to row, is thus gradually purified; and ultimately, by simple exposure to the rays of the sun is well evaporated, and yields crystals of sufficient purity for use. There are extensive works conducted in this manner, and their yearly produce which is upwards of 1000 tons, supplies not only the Pasha's wants, but affords considerable quantities for exportation.—*United Service Journal*.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough-court, Fleet-street.*—Sold by A. & W. Galignani, Rue Vivienne, Paris.

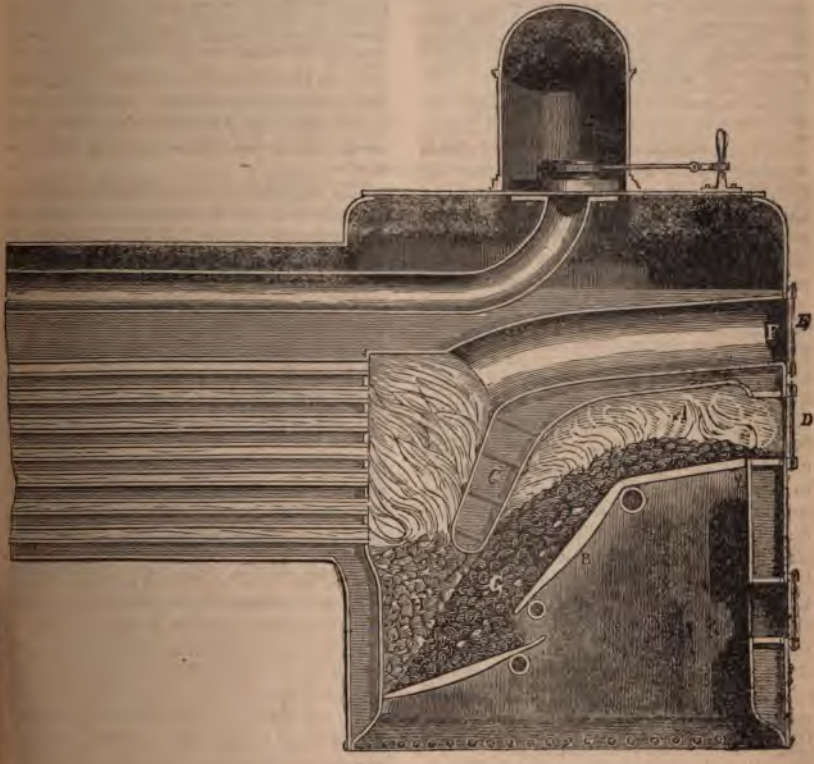
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 822.] SATURDAY, MAY 11, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

CHANTER AND CO.'S PATENT LOCOMOTIVE ENGINE FIRE BOX



USE OF COALS IN LOCOMOTIVE ENGINES, WITHOUT SMOKE—CHANTER AND CO.'S PATENT FIRE BOX.

The provision made in all Railway Acts, that the locomotive engines shall be worked free from smoke, has hitherto made it necessary that coke should be the only fuel employed, no means having been, down to a very recent date, discovered, of burning coal without smoke. The high price of coke, however, arising chiefly from the expense of working the coke-ovens without any advantage being derived from the heat expended in the process—has led to numerous attempts to devise a furnace by which coal could be employed without producing smoke—that is to say, by which not only the body of the coal, but all the fuliginous and gaseous matters evolved in the process of combustion should be wholly consumed, and nothing but a clear current of hot air or vapour escape from the funnel or chimney. When the attention of an inventive mind is absorbed in the endeavour to overcome any particular difficulty, such as this, by bringing to bear upon it the contrivances of other minds as well as its own, the object is almost always certain of being accomplished sooner or later; and so it has happened in the present contrivance of Mr. Chanter, who, by means of his own inventive powers, and by the purchased aid of many engineers of talent, has advanced, step by step in the improvement of coal burning furnaces as applicable to locomotive engines, till we are now happy to be able to announce that, if experimental workings are to be relied on, his efforts have been crowned with complete success.

The nearly total consumption of smoke in *stationary* steam engines, Messrs. Chanter and Co. accomplished some years since, and many of their furnaces are now at work in various parts of the kingdom, giving entire satisfaction to their owners; but the same plan which answered so well for stationary engines, was found wholly inapplicable to the peculiar circumstances under which a locomotive engine furnace works. The main features preserved in all Messrs. Chanter and Co.'s modifications are—1st: the *placing the fire bars at* an angle *sloping downwards from the door* of the *furnace—and, 2nd: the giving* a dip to *the bottom of the superposed* boiler, so that it should be in a somewhat parallel plane with the fire bars. Supposing the furnace to be in full operation, there will be on the bars a layer of fuel in different stages of combustion; at the bottom of the incline it will be clear red coke, in a state of complete incandescence, while rising towards the top it exists in a state of black raw coal just thrown into the furnace, and evolving volumes of dark smoke, which are thrown or deflected downwards by the bottom of the boiler, (called from this circumstance, the deflector) and having to pass over the red coke, are consumed. As the coke is exhausted to dross and falls through the fire bars, the superincumbent mass of unconsumed fuel falls down into its place, in consequence of the inclination of the bars; the highest point always being fed with raw coals by the fireman. Mr. Witty was, we believe, the suggestor of this judicious arrangement, which was perfected and carried out by Mr. Chanter; and has been found to act admirably in stationary engines.

The success attending the action of the inclined fire bars and deflector, in the common engine, led Mr. Chanter to endeavour to apply the plan to the fire box of the railway locomotive engine. The first that was built upon this plan was the "Prince George," of which we published an engraving in our 771st number. In working with this engine it was found that the motion of the engine and the tremendous force of the draft of the furnace, prevented the fuel remaining in that position upon the bars, which we have just described. Neither did the deflector come sufficiently low, merely dipping to about the level of the third range of tubes (out of nine); so that the smoke passed unobstructed, and consequently unconsumed into the boiler tubes, and through the funnel.

In the second engine that Mr. Chanter built,—"the Duke of Sussex"—a smaller degree of inclination was given to the fire bars, in order that the coals should rest longer upon them, and a fire-lump was attached to the bottom of the dip in the superposed boiler, so as to bring the upper deflecting surface down to a level with the sixth row of the boiler tubes, or two-thirds of their entire depth. These alterations were found to be considerable improvements; a great portion of the smoke was consumed, and the

fireman had less difficulty in stoking, and clearing out the fire-place, in consequence of the less abrupt inclination of the fire-bars. Still the invention was not sufficiently perfect to allow of its use on railways, and advancing a step further, the deflector was brought down, so as actually to dip into the coked fuel at the bottom of the fire-box; by which means the smoke from the newly supplied coal was compelled to pass through the incandescent body of coke below, where it became entirely consumed. At this point the invention worked well for a time; but the draft through the locomotive engine furnace was so great, that ere long it worked a clear way for itself under the deflector, the point of which it was found impossible to keep immersed in the burning fuel. One improvement more, however, we shall now proceed to describe, and this difficulty too was overcome.

The figure on our front page is a section of Messrs. Chanter and Co.'s last improved fire-box, showing also part of the boiler tubes. A is the furnace; B B B the fire bars, placed at three different angles which have been found most efficient in practice to the operation of the invention. C the deflector, forming a kind of pocket in the boiler, and which it will be seen dips into the burning fuel; D, the door through which coal is supplied to the furnace; E, the door through which a small quantity of coke is supplied, through the copper tube F to the inside of the deflector; G, burning coals; H, burning coke.

The action of this furnace will now be understood almost without further description. Coals are supplied through the fire door D, which are gradually coked and consumed; and in order to keep the bottom of the deflector bedded in the burning smokeless fuel, coke is supplied to the contrary side by the fire door E, through the strong copper tube F.

The practical results of the working of this engine have led to the conclusion that three-fourths of coal may be safely and beneficially used with one-fourth of coke. The present average price of coke on the Liverpool and Manchester and Grand Junction Railways is twenty-eight shillings per ton, and the price of the best round *coals eight shillings; three quarters of a ton of coals will* therefore *cost six shillings, and one quarter of a ton of coke seven shillings,* making thirteen shillings a ton for fuel; less than one half the present cost. It has been also proved by the best authorities that a ton of coals will produce more steam than a ton of coke; hence an additional saving. The coal is also less bulky than coke, and therefore of more convenient stowage in the tender.

Ample evidence of the truth of these statements will be found in the following reports. The first is made by the engineer and examiner of engines, of the well known firm of Mather, Dixon and Co., of Liverpool.

"I have superintended the working of the new locomotive engine (Duke of Sussex), with Chanter and Co.'s patent fire box, on the Grand Junction Railroad, four experimental trips.

"This engine has 13 inch cylinders, 18 inch stroke; steam was got up from cold water, within *two* hours, principally by coals. The first and second trip beyond Warrington, Crew, and back to Liverpool, we used from one-third to one-fourth coke, residue the common run of coal, with which she burned the smoke very well; in fact a very slight difference from a coke fire, and that only occasionally.

"With the third experiment we reduced the coke about one-sixth to one-eighth part, when a light smoke appeared, particularly when the under fire was not full of red coal or coke, and some extra trouble for the fireman to keep it full.

"The fourth experiment we tried her power, when from Stafford station to Crew station she ran from 45 to 50 miles per hour. When at Crew we took in a supply of coals, and worked her with coal only, when her power materially increased, and the power of steam was so great that we opened the fire doors. The engineer, Hewitt, of the Grand Junction, stated we were going beyond 50; I timed her by my watch and found her 60 miles per hour and above it.

"I consider the 'Duke of Sussex' engine very powerful, particularly with coals; and from these experiments I am convinced coals to a considerable extent can be used without any nuisance of smoke.

"WILLIAM PEOPLES,
"Engineer and Examiner of Engines at Mather, Dixon and Co.'s.

"Liverpool, April 3, 1839."

Some trifling alterations were made after the preceding Report, and we then have the following:—

"In giving my report of the trial of the 'Duke of Sussex,' locomotive engine, fitted up with Mr. Chanter's fire-box, I beg to

state that running her five days, I have paid particular attention to the progress of burning the smoke from coal, which I am now perfectly satisfied can be most effectually done. In the three first trials it was only partially burnt, but the last trial, since Mr. Jones has altered the situation of the lower bars and given more aperture, it is very considerably improved, and much more easy to work; as it now feeds itself when a large body of coal is kept at the feed mouth, and the smoke is more perfectly consumed, giving a rapid supply of steam. We took in at Acton half a ton of good round coal, and kept up strong steam the whole of the way to Liverpool, without any appearance of smoke while running. On stopping at Warrington to take in water, a light tinged smoke appeared, but which I think could not be considered a nuisance. While running the whole of the way from Acton to Liverpool (no coke being used) I could scarcely ascertain that there was any difference from a coke fire. I will also observe, that there does not appear to be any small ashes, or cinders, flying from the chimney top, as is the case with a coke fire. I consider Mr. Chanter's plan of smoke burning, to be most effectual, and the principle is fully proved.

"HARNOLD HEWITT,

"Engineer to the Grand Junction Railway Co.
"Liverpool, April 25, 1839."

The concluding paragraph of the last Report, points out a most important advantage resulting from the use of coals in locomotive engines—that is, the absence of those dangerous sparks which are continually issuing from the common engine chimney, to the torment of passengers, and the jeopardy of the luggage waggons, and the barns and haystacks on the road side. So momentous was this evil considered to be, that a Parliamentary Committee was appointed to examine into the subject, and to report on the best means of obviating it. No plan was, however, recommended by the Committee, and excepting the information gained from the evidence of the various witnesses, which we published in our xxvi th volume, the subject was left just as it was taken up. Could the absence of these burning flakes and sparks be ensured, a great additional pleasure would be afforded to the traveller, by permitting him to travel on the outside or in an open carriage, and enjoy *the scenery* and air, without the danger *of being blinded or burnt.*

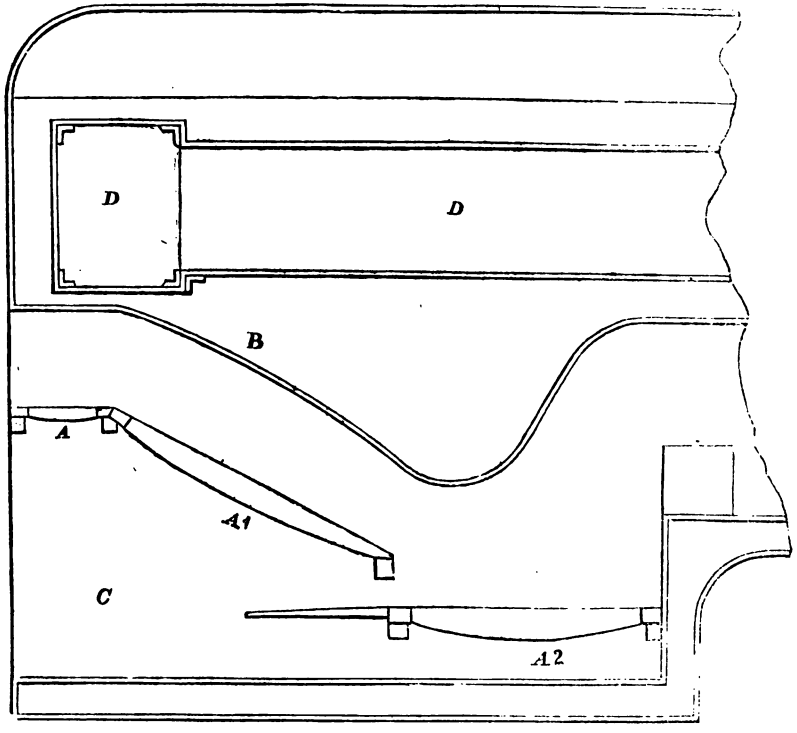
We may point out still another advantage resulting from the substitution of coals for coke as a fuel in locomotive engines. It has been found that on the railways, where the localities and other circumstances, allow of the use of coals in the ordinary locomotive engine, that the brass or copper boiler tubes do not wear out; and that generally when the engine has been condemned, the tubes are found to be quite sound. This has been found to be the case on the Garnkirk Railway, the Stockton and Darlington, and more particularly at the Newton Coal-works Railway. Now on the generality of railways, where coke is used as the fuel, the brass tubes have constantly to be renewed. This fact has been explained thus:—that the sharp particles of coke rushing through the tubes under the influence of a powerful draft, act like a file upon the interior of the tubes, soon destroying them by actual attrition. The soft particles of the coal smoke do not have this effect.

The transition desired to be effected by Messrs. Chanter and Co., from the use of coke to that of coal, on railways, is an important one, and a desideratum, which, if it can be effected, will be of immense advantage to the railway interest, and to the public in general. We have, therefore, been at some pains to lay clearly and impartially before our readers the evidence we have been supplied with, and been able to collect upon the subject.

CHANTER'S PATENT MARINE STEAM-BOILER FURNACE.

Although not under the restriction of legislative enactments to consume the engine smoke, as are railway companies —it appears to us to be equally imperative upon steam navigation proprietors to get rid of this nuisance—more especially in vessels engaged in river traffic. Setting aside the question of the economy of fuel resulting from the combustion of the smoke, the comfort of the passenger, which it is their interest to ensure, would appear to be motive enough to induce the adoption of some simple plan for the purpose. In all the methods which have been tried, the main objection has been, that the draft of the furnace was impeded. In Messrs. Chanter and Co.'s patent furnace this fault does not appear to exist. The principles

upon which the plan is founded will be found fully explained in the preceding article; it merely remains for us to describe the adaptation of the arrangement to a marine boiler. The annexed engraving is a longitudinal section of the furnace, and part of the boiler of a marine engine—A A' A^2 are the fire bars; B the deflective part of the boiler; C the ash pit; and D D the flue. This section is from the plans upon which Messrs. Peter Borrie and Company are



fitting boilers into the steam-boat "Enterprise," at Dundee. Mr. Napier, of Glasgow, is also putting similar boilers into another vessel. Should the plan be found to answer in these boats, we doubt not but that a little wholesome competition will speedily compel it to be adopted in all the river Thames steamers, if only for the sake of freedom from the nuisance; and should a moderate saving of fuel be effected, in steam vessels generally.

THE "BRITISH QUEEN."

Sir,—Seeing in No. 819 of your valuable and useful Magazine an inquiry by "Bow Bells," respecting the *British Queen* steamer, as to when she may be expected in this port, (she is advertised to sail from here the first of June,)—for my own satisfaction, and feeling interested about her, I wrote to a friend of mine in Glasgow respecting that vessel; he informs me, that the alterations found necessary to be made in her arrangements and plan inside, were such as to have required much time and labour to accomplish, in order to fit her for the station. It was found indispensable to take down the entire of the joiners' work, and to arrange it quite on a new plan; also, improvements were obliged to be made in the decorations and painting. In respect of her machinery, it was constructed

with the greatest care under the sole inspection of Mr. Robert Napier himself, and every part tried and proved to be sound before he allowed it to be used. Mr. Napier had to encounter with a great disadvantage, namely, when the *Queen* arrived in the Clyde it was found she could not safely be taken to his extensive works at Glasgow, where he has every convenience for hoisting in the machinery, &c.; instead of which he was obliged to put her in the wet dock at Port Glasgow, which caused a great delay and expense in conveying down the machinery, and erecting an immense platform above her deck, with other apparatus to take in the boilers, machinery, &c. When the engineers commenced to overhaul the engine-room, it was discovered that the London ship-wrights had not allowed them sufficient height in the hold for their engines; they had no other alternative, of course, but either to raise the deck, or lower the kelsons, about six inches: they adopted the latter. Now I think it must appear under all the circumstances, a few of which I have stated, that the delay complained of is not to be wondered at. In conclusion, I shall only remark, that with all the boasting of "Bow Bells," about the London expedition and superior workmanship of their builders, the people in the North think quite the reverse to him, for they consider the London-built ships very light and flimsy; in proof of which, amongst many other improvements made in the *British Queen* at Port Glasgow, it was deemed absolutely necessary to strengthen her with several additional iron knees. It is notorious that steam and other ships can be built and fitted out, decorated, and finished, as expeditiously on the Clyde as on any river in the world.

I am, Sir,
Your humble servant,
CALEDONIA.

May 1, 1839.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal* for Jan. 1839.]

APPARATUS FOR BLEACHING LINENS, COTTONS, &c., *Samuel W. Wright*.*—"My improvements in bleaching or cleansing linens, cottons, or other fibrous substances, and in the machinery or apparatus for effecting the same, consist, firstly, in the peculiar construction of an air-tight vessel, in which the goods, or fibrous materials, intended to be bleached, are to be packed in close contact. Secondly, in the manner of passing the alkaline solutions through the compact mass of goods, or fibrous materials, by the agency of steam at a high pressure, which has the effect of opening the fibres of the material under operation. Thirdly, in the manner of rinsing or washing out the alkaline or other chemical matter used in the process of bleaching, by means of high pressure steam. Fourthly, in the manner of forcing the solution of chloride of lime and sulphuric acid through the goods in the bleaching vessel by hydraulic and pneumatic pressure; and, fifthly, in the mode of washing, cleansing, or rinsing the chemical matters from the goods, after the bleaching operation has been completed; and, sixthly, in the mode or manner of drying the fibrous goods, or other substances, by passing high pressure steam through them, in a compact state, before removing them from the bleaching vessel, or kier."

This announcement of the objects and general mode of procedure, as set forth in the words of the patentee, will afford a perfectly clear idea of the nature of the invention, and of the kind of apparatus employed; after describing which, the patentee says, "It is obvious that the machinery, or apparatus, as above described, may be varied in its form and construction. I do not, therefore, intend to claim as my invention, the application of high pressure steam to be used with the improved combination and arrangement of the several parts as applicable to bleaching or cleansing linens, cottons, or other fabrics, goods, or other fibrous substances, as before described."

The process, as described, appears to be eminently well adapted to accomplish the intended purpose in a very perfect and economical manner.

CAST-IRON WHEELS TO BE USED ON RAILROADS, *Samuel Truscott, George Wolf, and James Dougherty, Pennsylvania*.—"We denominate our wheel, (say the patentees) the *Double Plate Car Wheel*, because we use two plates, instead of the spokes, or arms, usually employed, which plates are cast with the rim, and form one substance therewith. We give to the rim of our wheels the same form in all respects as is now given to the rims of car wheels, but instead of arms we cast our wheels with two parallel, or nearly parallel, plates, which plates are convex on one side, and concave on the other; the hub, or nave, which is to receive the axle, is cast in the centre of these plates, extending from one of them to the other.

* *Also patented in England.*

The accompanying drawing gives a sectional view of one of our wheels, *a a* being the rim, *b b* the front and back plates, convex on one

side, and concave on the other; *c c* being the hollow, or void space between them; and *d d* the nave or hub. The hollow, *c c*, between the two plates is formed by a core in the process of casting, which core is supported in the flask by leaving suitable holes in the plates for that purpose, which serve also for the removal of the sand of which the core is formed.

We cast our rim in a chill, in the usual manner, and in consequence of the particular form given to the plates, they contract in cooling without danger of fracture, and without its being necessary to divide the hub, as is done when car wheels are cast with spokes, or arms. The only effect of contraction is to flatten the two plates in a slight degree, operating in this respect like the curved arms of many cast-iron wheels.

We are aware that car wheels have been made with plates as a substitute for arms, but such plates have been made separate from the wheels, and united together by screw bolts, embracing the hub in a distinct piece between them. The difference between such wheels, and those constructed by us, is so obvious as not to need pointing out.

CAST-IRON CAR WHEELS TO BE USED ON RAILROADS, *Jonathan Bonney, Charles Bush, and George C. Lobdell, Delaware.*—The accompanying drawing shows a section of one wheel, which, instead of arms as usually employed, has each face thereof convex, a hollow space being left between the two surfaces. The rim of the wheel A A, does not differ from those usually employed, and is cast in a chill in the ordinary manner. The rim is united to the centre, or hub, of the wheel B B, by the two convex face plates *C C, which are cast in one piece with the rim and hub. The interior,* D D, between the two convex face plates, is formed by cores, supported in a way, well known

to iron founders. The hub has a transverse division E E, which separates it into two distinct parts, attached respectively to the face plates. This division is necessary to prevent the tension which would be produced by shrinkage in the casting, and which would endanger the breaking of the wheel. The hub, if preferred, may be cast solid, with the exception of the division E, and afterwards bored out; or it may be cored, and turned to receive the axle.

We are aware (say the patentees) that wheels have been made with double convex plates, both of cast and of wrought iron; but such plates were in separate pieces from the rims and hubs, being received into rebates on the rims, and embracing the hub between them, which extended through openings in their centres, the two plates being secured together by screw bolts; we are also aware that a plan has been devised for cast-iron wheels with two face plates, having a space between them formed by cores, as in our method, but the two plates were in this case parallel to each other, one of them being convex, and the other concave, on its face, the hub extending from one face to the other in a continuous piece, rendering it necessary, on account of shrinkage, to place the two plates as described; an arrangement which sacrificed strength to necessity.

By constructing the wheel so that the plates shall both be convex outwards, as they are in the position of the greatest strength, they may be made considerably thinner than would otherwise be admissible, and the wheel will consequently be lighter.

All that we claim as our invention, is the division of the hub into two parts, transversely, between two face plates, each convex outwardly, in the manner, and for the purpose, set forth.

TABLE OF RESULTS OBTAINED FROM EXPERIMENTS ON THE STRENGTH AND OTHER PROPERTIES OF CAST IRON, FROM THE PRINCIPAL IRON WORKS IN THE UNITED KINGDOM. BY MR. WM. FAIRBAIRN.

[Extracted from the Manchester Memoirs, Vol. vi., (Second Series.)]

In the following Table, each bar is reduced to exactly one inch square; and the transverse strength, which may be taken as a criterion of the value of each Iron, is obtained from a mean between the Experiments upon it, given in the Memoirs;—first on bars 4ft. 6in. between the supports; and next on those of half the length, or 2ft. 3in. between the supports. All the other results are deduced from the 4ft. 6in. bars. In all cases the weights were laid on the middle of the bar.

Number of Iron in the scale of strength.	Names of Irons.	Number of Experiments on each.	Specific Gravity.	Modulus of elasticity in lbs. per square inch, or stiffness.†	Breaking weight in lbs. of bars 4ft. 6in. between supports.	Breaking weight in lbs. of bars 2ft. 3in. reduced to 4ft. 6in. between supports.	Mean breaking weight in lbs. (S.)	Ultimate deflection of 4ft. 6in. bars, in parts of an inch.	Power of the 4ft. 6in. bars to resist impact	Colour. Quality.
1	Ponkey, No. 3, Cold Blast	4	7.122	17211000	567	595	581	1.747	992	Whitish gray..... Hard.
2	Devon, No. 3, Hot Blast*	2	7.251	22473650	537	—	537	1.09	589	White..... Hard.
3	Oldberry No. 3, Hot Blast	5	7.300	22733400	543	517	530	1.005	549	White..... Hard.
4	Carron, No. 3, Hot Blast*	2	7.056	17873100	520	534	527	1.365	710	Whitish gray..... Hard.
5	Beaufort, No. 3, Hot Blast	5	7.069	16802000	505	529	517	1.599	807	Dullish gray ..... Hard.
6	Butterley.....	4	7.038	15379500	489	515	502	1.815	889	Dark gray ..... Soft.
7	Bute, No. 1, Cold Blast.....	4	7.066	15163000	495	487	491	1.764	872	Bluish gray ..... Soft.
8	Wind Mill End, No. 2, Cold Blast..	4	7-071	16490000	483	495	489	1.581	765	Dark gray..... Hard.
9	Old Park, No. 2, Cold Blast.....	5	7.049	14607000	441	529	485	1.621	718	Gray..... Soft.
10	Beaufort, No. 2, Hot Blast	4	7.108	16301000	478	470	474	1.512	729	Dull gray ..... Hard.
11	Low Moor, No. 2, Cold Blast	4	7.055	14509500	462	483	472	1.852	855	Dark gray ..... Soft.
12	Buffery, No. 1, Cold Blast*	5	7.079	15381200	463	—	463	1.55	721	Gray ..... Rather hard.
13	Brimbo, No. 2, Cold Blast.....	5	7.017	14911666	466	453	459	1.748	815	Light gray ..... Rather hard.
14	Apedale, No. 2, Hot Blast.....	3	7 017	14852000	457	455	456	1.730	791	Light gray ..... Stiff.
15	Oldberry, No. 2, Cold Blast.....	4	7.059	14307500	453	457	455	1.811	822	Dark gray..... Rather soft.
16	Pentwyn, No. 2	4	7.038	15193000	438	473	455	1.484	650	Bluish gray ..... Hard.
17	Maesteg, No. 2	5	7.038	13959500	453	455	454	1.957	886	Dark gray ..... Rather soft.
18	Muirkirk, No. 1, Cold Blast*	4	7.113	14003550	443	464	453	1.734	770	Bright gray ..... Fluid.
19	Adelphi, No. 2, Cold Blast.....	5	7.080	13815500	441	457	449	1.759	777	Light gray ..... Soft.
20	Blania, No. 3, Cold Blast	5	7.159	14281466	433	464	448	1.726	747	Bright gray ..... Hard.
21	Devon, No. 3, Cold Blast*	4	7.285	22907700	448	—	448	.790	353	Light gray..... Hard.

22	Gartsherrie, No. 3, Hot Blast	5	7.017	13894000	427	467	447	1.557	998	Light gray ..... Soft.
23	Frood, No. 2, Cold Blast	5	7.031	13112666	460	434	447	1.825	841	Light gray ..... Open
24	Lane End, No. 2.....	3	7.028	15787666	444	—	444	1.414	629	Dark gray ..... Soft.
25	Carron, No. 3, Cold Blast *	5	7.094	16246966	444	443	443	1.336	593	Gray..... Soft.
26	Dundivan, No. 3, Cold Blast.....	4	7.087	16534000	456	430	443	1.469	674	Dull gray..... Rather soft.
27	Maesteg (Marked Red).....	5	7.038	13971500	440	444	442	1.887	830	Bluish gray ..... Fluid.
28	Corbyns Hall, No. 2	5	7.007	13845866	430	454	442	1.687	727	Gray..... Soft.
29	Pontypool, No. 2.....	5	7.080	13136500	439	441	440	1.857	816	Dull blue ..... Rather soft.
30	Wallbrook, No. 3	5	6.979	15394766	432	449	440	1.443	625	Light gray ..... Rather hard.
31	Milton, No. 3, Hot Blast	4	7.051	15852500	427	449	438	1.368	585	Gray ..... Rather hard.
32	Buffery, No. 1, Hot Blast*	3	6.998	13730500	436	—	436	1.64	721	Dull gray..... Soft.
33	Level, No. 1, Hot Blast.....	5	7.080	15452500	461	403	432	1.516	699	Light gray ..... Soft.
34	Pant, No. 2.....	5	6.975	15280900	408	455	431	1.251	511	Light gray ..... Rather hard.
35	Level, No. 2, Hot Blast.....	6	7.031	15241000	419	439	429	1.358	570	Dull gray..... Soft.
36	W. S. S., No. 2	5	7.041	14953333	413	446	429	1.339	554	Light gray ..... Soft
37	Eagle Foundry No. 2, Hot Blast ..	4	7.038	14211000	408	446	427	1.512	618	Bluish gray ..... Soft.
38	Elsicar, No. 2, Cold Blast.....	4	6.928	12586500	446	408	427	2.224	992	Gray ..... Soft.
39	Varteg, No. 2, Hot Blast	4	7.007	15012000	422	430	426	1.450	621	Gray ..... Hard.
40	Coltham, No. 1, Hot Blast.....	5	7.128	15510066	464	385	424	1.532	716	Whitish gray ..... Rather soft.
41	Carroll, No. 2, Cold Blast.....	4	7.069	17036000	430	408	419	1.231	530	Gray ..... Hard.
42	Muirkirk, No. 1, Hot Blast*.....	4	6.953	13294400	417	419	418	1.570	656	Bluish gray ..... Soft.
43	Bierley, No. 2	5	7.185	16156133	404	432	418	1.222	494	Dark gray ..... Soft.
44	Coed-Talon, No. 2, Hot Blast*....	4	6.969	14322500	409	424	416	1.882	771	Bright gray ..... Soft.
45	Coed-Talon, No. 2, Cold Blast*..	5	6.955	14304000	408	418	413	1.470	600	Gray..... Rather soft.
46	Monkland, No. 2, Hot Blast.....	3	6.916	12259500	402	404	403	1.762	709	Bluish gray ..... Soft.
47	Ley's Works, No. 1, Hot Blast....	3	6.957	11539333	392	—	392	1.890	742	Bluish gray ..... Soft.
48	Milton, No. 1, Hot Blast	4	6.976	11974500	353	386	369	1.525	538	Gray..... Soft and fluid.
49	Plaskynaston, No. 2, Hot Blast....	5	6.916	13341633	378	337	357	1.366	517	Light gray ..... Rather soft.

The irons with asterisks are taken from the Experiments on Hot and Cold Blast Iron, made by Mr. Hodgkinson and myself for the British Association for the Advancement of Science.—See Seventh Report, Volume VI.

† The modulus of elasticity was usually taken from the deflection caused by 112lbs. on the 4ft. 6in. bars.

Rule.—To find from the above Table the breaking weight in rectangular bars, generally, calling b and d the breadth and depth in inches, and l the distance between the supports in feet, and putting 4.5 for 4ft. 6in., we have $\frac{4.5 \times b\, d^2 S}{l}$ = breaking weight in lbs.—The value of S being taken from the Table above.

For example:—What weight whould be necessary to break a bar of Low Moor Iron, 2 inches broad, 3 ins. deep, and 6 feet between the supports? According to the rule given above, we have $b=2$ inches, $d=3$ inches, $l=6$ feet, $S=472$ from the table. Then $\frac{4.5 \times b\, d^2 S}{l} = \frac{4.5 \times 2 \times 3^2 \times 472}{6}$ = 6372lbs., the breaking weight.

MR. JOSIAH PARKES ON THE INFLUENCE OF THE PROPORTIONS OF THE PARTS, ON THE PERFORMANCE OF BOILERS FOR A GIVEN WEIGHT OF COAL.

[From a Paper read before the Institution of Civil Engineers, April 23rd.]

Evaporation may be considered as the measure of the useful effect obtained from any weight of fuel, or, together with the duty done by an engine, the measure of the useful effect of a given weight of water in the shape of steam. The author insists on the importance of ascertaining with accuracy, the weight of the water which in the shape of steam has passed through the cylinder of an engine. The weight of water or quantity of steam requisite for producing a given effect or duty, was the subject of continual research by Smeaton, and the basis of Watt's discoveries. The author being led to make observations on evaporation twenty years ago, soon perceived that the completeness and rate of combustion, the proportion of the grates to the combustion effected upon them, and to the whole heat-absorbing surface, were important elements in evaporative economy. These elements, in the author's own experiments at Warwick—where slow combustion was pushed to nearly its furthest limit—in those of Smeaton at Long Benton —of Rennie and Watt at the Albion Mills— of M. De Pambour on the locomotive engine, in which intensity of combustion and evaporative power are at their highest limits —of Nicholas Wood on the Killingworth Engine—and of Mr. Henwood and others on the Cornish Boiler, are the data for the analysis of the principle, which the author now attempts to develope as the true principles of evaporative economy.* The authentic facts here recorded of the working of boilers and engines of established credit and notoriety, will enable the employer of any boiler or engine to compare his practice with specimens of acknowledged and well-attested merit. The results derived from the above data are arranged in a tabular form, so as to exhibit at once the relation which any one property and the several parts of the boiler bear to any other, and to the effects produced, the amount and activity of the combustion (to which the author assigns the term *calorific forces*), and the modifications it experiences by the structure and disposition of the several parts. There are also certain quantities and relations which exert a peculiar influence over the results, which being rightly ascertained are exponential or indicative of the practice of each particular boiler: these Mr. Parkes calls the *exponents* of that boiler, and are as follows:—The quantity of coal burnt under a boiler in a given time,—the quantity burnt on each square foot of grate per hour,—the quantity of water evaporated per square foot of heated surface,—and the number of pounds of water evaporated by a given quantity of coal. Besides this, the influence of *time*, that is, the time of duration of any given portion of heat about a boiler, and about equal areas of surface, demands our most attentive consideration, and is specially treated of at the close of the paper. It appears most distinctly, that the boilers, tested as to their merit by their respective evaporative economy, arrange themselves in the inverse order of the rate of combustion. The Cornish boiler, being greatly superior to all the others, when tested in this manner, as well also as in respect of time, is selected as the standard of comparison, whereby to mark the scale of descent from the highest point of excellence yet attained in evaporative economy. For this purpose then the Cornish results are considered as unity.

The values of the exponents for the Cornish, waggon, and locomotive boiler, respectively, are collected together in the following table, which will serve to show, at one glance, the respective values of the boilers on this comparison:—

Boiler.	lb.		
Cor.	1.0 of coal, burnt under one boiler in	44.08	seconds.
†Wag.	1.0 ditto ditto	16.57	..
Loc.	1.0 of coke, ditto	6.45	..
Cor.	3.4 of coal, burnt on each square foot of grate per hour.		
Wag.	10.7 ditto ditto		
Loc.	79.3 of coke, ditto		
Cor.	1.0 of water, evaporated by 1 square foot of heated surface per hour, from 212°.		
Wag.	7.1 ditto ditto		
Loc.	12.0 ditto ditto		
Cor.	11.8 of water, evaporated by 1 lb. of coal from 212°.		
Wag.	8.8 ditto ditto		
Loc.	7.2 ditto 1 lb. of coke, ditto		
Loc.	*5.4 ditto* 1 lb. of coal, ditto		

* *The author has been unable to obtain any similar data for the Marine Boiler.*

† The results for the waggon boiler are the mean for eight boilers.

The Cornish boiler possesses some peculiar advantages, both as regards structure, and the practice of slow combustion; since, by the former, great strength is attained, and, by the latter, time is given for the complete combination of air with the heated fuel, for the transmission of heat through the metal, and for the escape of the steam through the water. The plates of the Cornish boiler are usually half an inch thick, whereas those of a low pressure boiler are usually 1-4th to 5-16ths of an inch thick: thus a much larger extent of surface is necessary to transmit a given quantity of heat in a given time in the former than in the latter case. The Cornish engineers allow seven times as much surface as in the general waggon boiler practice for the evaporation of equal weights of water in equal times, and twelve times as much as in the locomotive; from which there is a gain of from 30 to 40 per cent. in the former, and of 64 with coke, and 100 with coal, in the latter case. The waggon boiler has great disadvantages of structure, being ill adapted to resist internal pressure, liable to collapse, and greatly affected by incrustation. According to the above table, which exhibits the mean of eight experiments, the combustion is two and a half times more rapid per boiler, and three times more rapid per square foot of grate per hour, and the rate of evaporation is seven times greater than in the Cornish. The loss of heat, the Cornish being unity, is 24½ per cent. The construction of the locomotive boiler is so very different from that of every other species of evaporative vessel, that no strict analogy can be drawn betwixt it and any other. From the above practical results, it appears that the rate of combustion, per boiler, is nearly seven times, and per square foot of grate, per hour, 23 times more rapid: that the rate of evaporation, from equal surfaces, is twelve times more rapid than in the Cornish boiler. The loss of heat, the Cornish being unity, 51 per cent. The author discusses, at length, the varying circumstances connected with different boilers, and the corresponding influence on the above results, and particularly the system of management by which he was enabled, with a waggon boiler, to approach the Cornish results. The table accompanying this paper will frequently enable the intelligent employer of a boiler to ascertain the best proportion of parts and the best practice. For, having decided on the quantity of steam he requires, he knows the quantity of fuel which will generate it if he adopts the measures of surface and proportions of parts which have *given relative effects; or he can ascertain whether his present practice be good* or defective. Notwithstanding the great stride which has been made in the economy of fuel by the Cornish engineers, the sources of waste are still great; and we may hope for great advances in evaporative economy, when combustion, as a science and practical art, has received the attention which it merits. The effect of a different practice, as regards rapidity of combustion and arrangement of parts, entirely disturbs the relation betwixt boilers of equal surfaces. The table shows an almost perfect identity in the total, the radiant, and the communicative areas between the mean of eight experiments on the waggon, and eleven on the locomotive boiler; and the locomotive boiler would present between three and four times greater surface to absorb the heat generated on the grate, than the waggon, if the rate of combustion were the same in both; but the rate of combustion is seven times more rapid in the locomotive, and consequently the locomotive does not offer one-half the surface of the waggon boiler for the absorption of the heat produced from equal weights of fuel in the same time. The result of this discordant practice is a loss, by the locomotive, of 1-3d of the heat which is realized in the waggon boiler; that the rate of evaporation from equal surfaces is augmented in the locomotive by 65 per cent., so that the increase of evaporative power is attended by a sacrifice of 33 per cent. of fuel. The locomotive possesses peculiar advantages in the thinness of the metal composing the tubes, and the subdivision of the heat, but these are more than neutralized by the exceedingly short period of the duration of the heat from any given quantity of fuel about the boiler. This most important subject of time is discussed in a series of propositions based on the following principles. The structure of the boiler and its mode of setting occasion the heat to travel greater or less distances, and over very unequal extents of surface in equal times, and the value of time will be appreciated by referring it to the rate of combustion, to the distance passed over by the products of combustion before they quit the boiler, the time in which the heat traverses the boiler, and to the period of the duration of the heat about equal areas of surface. These remarkable elements give rise to eleven propositions, which are fully discussed and illustrated by tabulated results. The peculiar action which takes place on the metal of the boilers, is indicated by the phrase, *intensity of calorific action*, since there are involved many actions which are entirely independent of the temperature of the fire. The relations furnished by some of these propositions, are facts as regards the relative action of the fires, and furnish

approximate measures of the effects of different systems of practice on the durability of the boiler.

THOMPSON'S IMPROVEMENT IN THE MANUFACTURE OF PRUSSIAN BLUE.

The Gold Isis Medal was last year awarded by the Society of Arts to Mr. Lewis Thompson, of Old Barge House, Lambeth, for his improved mode of manufacturing Prussian blue. We extract the following description of the process from the last publication of the Society's Transactions ;—

"In the usual mode of manufacturing Prussian blue, the requisite carbon and nitrogen are obtained by decomposing animal matter in contact with potash. In this process the potash, being reduced to the metallic state, causes the formation of cyanogen, in consequence of its affinity for that substance. The quantity of nitrogen furnished by a given weight of animal matter is not large, and, in the material employed by manufacturers, seldom perhaps exceeds eight per cent. ; and of this small quantity at least one half appears to be dissipated during the process, thus producing an enormous waste of material, and at the same time increasing the size of the apparatus. Reflecting on these circumstances, it occurred to me that the atmosphere might be made to supply, in a very economical manner, the requisite nitrogen, if allowed to act on a mixture of carbon and potash under favourable circumstances. The experiment proved on trial to be correct, and in some measure exceeded my expectation ; for the carbonaceous matter employed may be worked over again many times, and is even improved by each operation. I found it necessary to use iron, for a reason which will be apparent in the explanation of this process ; when iron is not employed, a much higher temperature is required.

"To produce Prussian blue, the following method may be adopted, but experience alone can teach us the best proportions ; and in this, as in most of the arts, the caprice of each manufacturer will probably lead to the adoption of various proportions of the ingredients used.

Take of potash or pearlash, 2 parts ;
coke, cinders, or coals, 2 parts ;
iron turnings . 1 part.

Grind the whole together into a coarse powder, and place it in an open crucible or other convenient vessel, and expose the whole for half an hour in an open fire to a full red heat, stirring the mass occasionally. During the process, little jets of purple flame will *be observed to arise from the surface of the mixture ; when these have almost* ceased to appear, which will happen in about the time specified, the whole must be removed from the fire, and allowed to cool ; water is now to be added, so as to dissolve the matter soluble in that fluid, and the black matter remaining put aside for another operation. The solution, after being filtered, is to be mixed with one part of copperas, and muriatic acid added in the usual way to brighten the colour of the precipitate. The quantity of Prussian blue produced from a given weight of pearlash or potash is generally about one-fourth of the weight of the pure potash contained in the salt ; but the larger the quantity operated upon at one time, the larger is the relative produce. Thus six ounces of pearlash, containing 45 per cent. of alkali, yielded only 295 grains of Prussian blue, whilst one pound of the same pearlash yielded 1355 grains. The Prussian blue here spoken of is the pure perferrocyanate of iron.

"In this process the potash is decomposed by the iron, producing potassium, which, being volatile, rises and combines with the carbon of the coke and with the nitrogen of the atmosphere, the oxygen of which has been removed by passing through the fire, or by the coke or cinders. In the mixture, the cyanide of potassium thus formed is next dissolved in water, and furnishes ferrocyanate of iron on the addition of sulphate of iron and muriatic acid, according to the explanation given in most chemical books.

"By deflagrating a mixture of nitrate of potash, coke, or small coals, and iron turnings, a mass is obtained which furnishes abundance of Prussian blue ; but, in this case, the nitrogen is derived from the decomposition of the nitric acid of the nitrate of potash, for the experiment succeeds equally well in a close vessel. In these experiments, soda may be substituted for potash without affecting the result : the charcoal from most kinds of vegetables cannot, however, be employed in place of that from coals, as it is very porous, and burns away too quickly. The presence of cyanide of sodium in barilla, kelp, and English alkali, is thus easily accounted for ; and the small quantity of cyanide of potassium invariably produced during the process of preparing potassium, admits of a similar explanation."

THOMPSON'S METHOD OF PURIFYING COPPER.

The same gentleman (Mr. Thompson) as was rewarded for his improvements in making Prussian blue, received also a gold medal for the following new method of purifying copper :—

"The art of manufacturing copper appears to have been known from the most remote antiquity: indeed, judging from the purity of the coins and warlike instruments which have descended to us, we might at first suppose that this, like some other of the arts formerly in use, had been partially lost, and that the ancients were better acquainted with the mode of making pure copper than we are at the present day. The great purity of their cupreous alloys is, however, much better accounted for, by attributing it to the richness of the ores then in use: for, in all probability, they were unable to extract copper from such poor pyritic ore as is now employed for that purpose, and from which English commercial copper is obtained, in a state of sufficient purity for the ordinary purposes to which copper is applied. It is always, however, contaminated with the foreign matters existing in the ore: these are chiefly iron, lead, arsenic, sulphur, and antimony; carbon, too, is occasionally imparted during the process of reduction. These impurities vary from two to seven per cent., and greatly impair the ductility and malleability of the metal. With one-half per cent. of arsenic, sulphur, or antimony, copper is decidedly brittle under the hammer, and with one per cent. this effect becomes very obvious. Lead and iron have a less injurious effect; but in the proportion of two per cent., they materially affect the colour and texture, and the alloy has a harsh, dull, and mottled appearance when polished. With a very small quantity of carbon, copper is brittle, and has a gray, uneven fracture.

"The Swedish copper being almost free from these impurities has long been held in high estimation, not only in this country, but also on the Continent, where the finer kinds of brass are made almost solely with it, to the exclusion of the English copper; a cheap and effectual mode of removing the impurities from which, has long been a desideratum. The following method will be found to answer that purpose, and its simplicity is such as to require no particular care or management on the part of the workmen:—

Take of impure copper.... 100 parts;
Copper scales .... 10 parts;
Ground bottle glass,
or any other flux 10 parts;

heat the whole together in a covered crucible, and keep the copper in a state of fusion for twenty minutes or half an hour, at the end of which time it will be found at the bottom of the crucible, perfectly pure. The quantity of copper scales must vary in proportion to the supposed impurity *of the copper to be operated on; but the proportions here given will be found to answer very well for the* average kind of English copper. The explanation of this process is sufficiently simple; the impurities contained in the copper, consisting, as we have seen, of iron, lead, arsenic, &c., combine with the oxygen contained in the copper scales, and form oxides or acids, which are dissolved by the flux, or fly off in a gaseous form, leaving the purified copper, together with that reduced from the scales, at the bottom of the crucible; consequently, the copper obtained exceeds that put into the crucible, the gain generally averaging from one to one and a half per cent. In this way I have obtained perfectly pure copper, from brass, bell-metal, gun-metal, and several other alloys containing from four up to fifty per cent. of iron, lead, antimony, tin, bismuth, arsenic, &c.

In my earlier experiments, I made use of the oxide of copper obtained from the acetate or sulphate, and proposed in practice to employ some of the native oxides of sufficient purity, such as the malachites. Mr. Aikin, however, has since kindly pointed out to me the scales of copper, as the cheapest and most abundant source for obtaining the oxide, since they are produced in large quantities at every copper manufactory. I have repeated nearly the whole of my experiments with them, without observing any variation in the result, as might, indeed, have been anticipated.

DESCRIPTION OF AN IMPROVED MACHINE FOR CUTTING THE ENDS OF RAILWAY BARS.

[Communicated to the Institution of Civil Engineers by Mr. Joseph Glynn.]

The advantage of having the ends of the railway bars cut as nearly square as possible, that they may truly abut against each other, is so great, that many attempts have been made to effect it. The author in this communication describes the method which is adopted at the Butterley Works in the manufacture of the rails for the Midland Counties Railway. In general the ends, rough and ragged as they come from the rolls, are separately re-heated and cut off by the circular saw, but the accuracy in this case depends on the workmen presenting the bar at right angles to the plane of the saw. As this cannot be insured, the difficulty is here obviated as follows: The axis of the saws and the bed of the machine, which is exactly like that of a slide lathe, are placed at right angles with the line of the rolls in which the rails are made; the saws are fixed in headstocks and slide upon the bed, so as to adjust them for cutting the rails to the exact length, and are three feet in diameter and one-eighth of an inch in thickness, with

teeth of the usual size in circular saws for wood, and make 1000 revolutions per minute; the teeth are in contact with the hot iron too short a period to receive any damage, but to prevent all risk the lower edge of the saw dips in a cup of water. The saw plate is secured between two discs of cast iron faced with copper, and exposed only at the part necessary for cutting through the rail. The rail on leaving the rolls is hastily straightened with wooden mallets on a cast iron plate, on which it lies right for sawing, and sufficiently hot; thus a considerable saving of time, labour and heat is effected. The rail is brought into contact at the same time with the two saws, and both ends are cut off by one operation. If the saws be sharp and the iron hot, the 78lb. rails are cut through in twelve seconds. The rail on leaving the saws is placed in a groove planed in a thick cast iron plate; thus all warping is prevented.

ROYAL INSTITUTION.—PHOTOGRAPHY.—MR. COOPER'S LECTURE ON HIS "BAROSCOPE."

April 26.—*The Conversazione.*—Photogenic *drawings* and *etchings* have, with the exception of some minor improvements in the chemical process, to depend on the abilities of the artist for their progress towards perfection; but in regard to photogenic *copyings* from nature, or from existing works of art, it cannot be expected that any considerable advance will be made, until the system is entirely changed, and placed on the same footing as that of M. Daguerre's, so as to give immediately the lights and shades as in the original. Still, however, something may be done on the principle of taking second impressions, and we have to report that Mr. C. Golpin has succeeded in obviating in some degree the difficulties which have hitherto prevented anything satisfactory being produced by this method. An impression taken after this manner was exhibited, and though it presented a hazy appearance, still it may be regarded as marking a progress in the art. The indistinctness, also, may be partly attributed to the character of the original, the first copy having been taken from one of those intaglio plates of porcelain, which on being held up to the light exhibits such pleasing effects. This first impression was received on a very thin sheet of paper, but previously to using it as a means of producing a series of second impressions, all the shades were rendered more *opaque*, by going over them with a pencil. *The effect might have been still further heightened, we think, by increasing* the transparency of the other parts with a varnish that would not spread, or by cutting out in places where great breadth and depth of shadow was required. There were also exhibited some photogenic copies of medals, sent by Mr. Golpin, produced through the medium of transparent intaglio casts, which were taken probably in isinglass. This is a good application of the art. We must not omit to mention, that besides many other things not requiring particular notice, there was a pleasing bust of the Queen in wax by Mr. Rivers, and a curious application of porcelain, namely, to the manufacture of bed-posts and curtain-poles. The specimens exhibited were very splendid, and came from Messrs. Brameld and Co.

The Lecture.—The subject of Mr. J. T. Cooper's lecture was the instrument invented by him for measuring altitudes, and which he terms the "Baroscope." Preliminary to entering on its description, the lecturer gave very ample elementary information on the mechanical properties of the air, which were excellently illustrated by experiments; but we would gladly have exchanged three-fourths of this matter for more explicit information in regard to the adjustments of the instrument, and the points of resemblance and difference between it and the barometer, and also on the more immediate principles in connexion with which it becomes a measurer of altitudes. We are convinced that the intellectual character of the audience assembling at this Institution is underrated, and that *general* scientific information is more diffused than men exclusively devoted to it are apt to imagine. Even with respect to the ladies, we cannot suppose they would feel any interest in attending these meetings, appropriated as they are to the illustration of particular points in science, unless they were already in possession of considerable elementary knowledge. Still this kind of information need not be wholly excluded, but there is a proportion, a manner, and a bearing to be observed in regard to it, which it would seem requires a peculiar talent duly to appreciate.

We shall not follow the lecturer, but confining our attention to the instrument, shall offer our own explanation in regard to it. The term "baroscope," which was the ancient appellation of the barometer, Mr. Cooper has very appropriately applied to his instrument, for it is the indicator rather than the measurer of the weight of the atmosphere. In the barometer this is determined at once by an equiponderant column of mercury, but in the baroscope it is a matter of inference, obtained in a manner presently to be explained; but in both instruments, it must be remarked, the datum

immediately ascertained is the weight or pressure of the atmosphere, and not the density of the air, and consequently the altitudes, as determined by the baroscope, must undergo the same corrections for the temperature of the air, &c., as are necessary in the case of the barometer. To obtain then the difference of atmospheric pressure at different stations, Mr. Cooper takes an oblong vessel, which, on account of some analogies in the case, we shall call a balloon, and fills it with water through a small aperture in its bottom. He then takes from it a given measure of the water, by which means he secures at all times precisely the same quantity of air in the balloon. He then inverts it in a vessel of water, in which, in consequence of the proportions previously adjusted between the weight of the balloon and the quantity of water extracted, it is sufficiently buoyant to float; and by nicer adjustments of weights, it is made to float with its stem carrying a small cup for holding the weights, a certain marked height above the water. Now it is evident, that if the surface of the water is pressed upon in a further degree than it is already pressed by the atmosphere, say by descending from the place where the adjustment is made, it will enter by the aperture of the balloon, and condensing the air in it, will cause it to sink. On the other hand, if the pressure is relaxed by ascending to a higher station, the inclosed air of the balloon, expanding and driving out the water, will cause it to rise. Now, in order to make the balloon float at the proper point of immersion, it will be necessary in the one case to take from, and in the other to add to, the weights in the cup, which differences of weights will indicate the differences of atmospheric pressure. But they will express only the relation between them, and not the absolute quantities of the differences—to obtain these, an experiment is necessary. Let the instrument be placed under the receiver of an air-pump, and let the before-mentioned proportions of it be such, that when a column of mercury, in connection with the receiver, stands at 30 inches, the balloon shall float at the appointed depth in the water, with a certain number of grains weight in the cup, and with, say, 1500 grains in addition, when the mercury stands at 15 inches. We shall then have 100 grains, expressive always of a difference of pressure equivalent to one inch of mercury, or $\frac{1}{15}$ of a grain to $\frac{1}{1500}$ of an inch; and this will be the case whatever may be the variation in the volume of air in the balloon, by a difference in the temperature of the water, *provided however, that the same temperature, such as it may be thought expedient to produce, be preserved in the* observations taken at the different stations. For this purpose a lamp forms part of the apparatus; and thus *instrumental* corrections, on account of difference of temperature, moisture, and expansion, are ingeniously avoided. If the same circumstances are observed in any observation as those under which the experiment was made with the air pump, that is, in respect to the weights in the cup and the temperature of the water, it is evident, that the more or less weights required to make the balloon float correctly, will give the absolute height of the barometer for the time or place of observation. It will be seen that the advantages which the instrument offers, are entirely of a practical kind, consisting chiefly in its portability, and freedom from all risks of derangement, which, to a *voyageur*, will compensate for a little tediousness in the manner of taking the observations, arising principally from the vertical oscillations of the balloon. These render it difficult to determine exactly the degree of immersion, and may influence the correctness of the results. Mr. Cooper, however, says that he obtained the height of the whispering gallery in St. Paul's, by means of his instrument, within a half of a foot of what he determined it to be by measurement. The evil arising from capillary attraction round the stem of the balloon, may, we think, be easily avoided; and, as an additional precaution, ought not the water to be boiled, in order to expel the air that it contains, and which, otherwise, will adhere to the balloon in bubbles, and affect its buoyancy?

NOTES AND NOTICES.

Wilkinson's Patent Wheel Rifle.—Several English and French officers and gentlemen assembled on Friday morning on the shooting ground near the Hippodrome, Bayswater, to witness experiments with the patent wheel rifle, recently invented by Mr. Henry Wilkinson, of Pall-mall. Nothing, as acknowledged by all present, could excel the rapidity and precision of the firing. Mr. Wilkinson commenced by discharging each wheel, containing seven charges, in fifteen seconds, or at the rate of twenty-eight balls per minute, nearly all of which hit the target at 100 yards, and several the bull's-eye. General Wright then gave the word of command, "Load, cock, fire," which was obeyed as rapidly as uttered, although correct aim was taken each time. The rifle was discharged 105 times, without once missing fire, or any impediment, and appeared capable of doing so double that number without cleaning. The construction of this rifle is very simple, merely a wheel, containing seven complete charges, revolving on a centre, which when discharged can be replaced in an instant by other wheels carried in the belt so as to keep up a continuous discharge. It appears admirably calculated for the sports of India, as also for deer-shooting, and on a more extended scale for all military purposes.

Balloon Travelling.—The Cheltenham Chronicle tells us that the scientific gentlemen who accompanied Mr. Green in the Nassau balloon, are now

trying an experiment preliminary to the establishment of a *line of balloons* between Cheltenham and London, so as to supersede (if possible) every other mode of travelling!

Galvanic Engraving in Relief.—While M. Daguerre and Mr. Fox Talbot have been dipping their pencils in the solar spectrum, and astonishing us with their inventions, it appears that Professor Jacobi, at St. Petersburgh, has also made a discovery which promises to be of little less importance to the arts. He has found a method—if we understand our informant rightly—of converting any line, however fine, engraved on copper, into a relief, by a galvanic process. The Emperor of Russia has placed at the Professor's disposal, funds to enable him to perfect his discovery.—*Athenæum.*

New Light for Lighthouses.—A letter of the 10th of March from Trieste, states that a new system of producing light for lighthouses has been invented by a serjeant-major in the Austrian artillery, named Selckonsky. The apparatus consists of a parabolic mirror, 62 inches by 30, with a twelve-inch focus, and the light is produced by a new kind of wax candle, invented by M. Selckonsky. It has been tried under the inspection of the Austrian Lloyd's Company in the port of Trieste, by being erected on the mast of a vessel. The light is said to have illuminated the whole of the port and the surrounding parts of the town equal to the moon at full, and at the distance of six hundred yards the finest writing could be read. A second trial has been made in bad weather, and the result was proportionably favourable.

The Pneumatic Railroad revived.—A second series of experiments with models, upon a modelled railroad, of Clegg's atmospheric principle of propelling carriages by means of exhausting a tube laid down the line of road to be traversed, of the air contained in it, and creating a vacuum, was made on Tuesday forenoon at the iron works of Messrs. Samuda, Southwark. The tube being exhausted by means of an air pump, the models, the leading one having a piston which forced open the valve of the tube, proceeded at a rate of extreme velocity along the line, a distance of thirty or forty yards, the ascent being one foot in thirty; the models were heavily laden, each carrying a couple of persons, and upwards of 15 cwt. of ballast being disposed over the whole. There were present several members of parliament and railway directors, engineers, &c. The machinery performed to perfection and gave general satisfaction. The advantages that this system proposes, both for the public and the railroad proprietors, are very obvious—cheapness, security, speed, and no danger of explosion; it is, in fact, free from those disadvantages which the present system in operation abounds in.—*Examiner.*

The "Ironsides."—This, the first sailing vessel constructed of iron which has ever been dispatched to encounter the risk of a transatlantic voyage, and which left Liverpool some five months since, for the Brazils, entered the Mersey on the 1st of May. The homeward passage from Aricati was accomplished in forty days, which is considered to be no despicable achievement, as during the whole trip light winds prevailed. The return of the "*Ironsides*" has completely established the practicability of navigating the ocean safely and surely in ships constructed of iron, the compass, whose action it was predicted would invariably be deranged, worked correctly; and the superiority of the material of which she is built, is proved by the fact, that from the day on which she sailed for Pernambuco, during the time she remained at the Brazils, and in the course of her voyage home, on no one occasion was it necessary to use the pumps; in fact, her hull is absolutely and literally water tight. This indemnity against leaking is no unimportant advantage, the proof of it, occurring too, as it does, at a time when timber is scarce, and consequently dear. So little has the "*Ironsides*" suffered from exposure to wind and weather, that her external appearance would induce the opinion that she had but lately been launched. Her tonnage is 264 tons; draft of water aft, 8 ft. 7 in.; forward 8 ft. 3 in.; her cargo consists of 1,800 bales of cotton.

Common Road Steam Carriages.—There are now three companies on the tapis for the purpose of attempting to establish steam locomotion on common roads—Sir James Anderson's, Walter Hancock's, and "The Maceroni Common Road Steam Conveyance Company." The proverb says, that the third attempt is sure of good luck—*Nous verrons.* Mr. Alexander Gordon, whose common road rhapsodies so highly entertained our readers and the scientific world in general, a few years ago, is appointed engineer, and we presume has some grand and notable project in hand for subverting the laws of nature. We are informed that he is now applying for a patent for a new mode of applying the power of steam. But what of our persevering friend the Colonel? Is he to be the mere name-father of the scheme?

Steamers from the Clyde to New York.—A joint-stock company is now forming in Glasgow, for carrying passengers and merchandise between the Clyde and New York, by means of an iron steamship of great power and capacity, to sail at the rate of at least sixteen miles an hour, thereby making a passage in about ten days, and enabling this vessel to make nearly a monthly voyage to America. The capital is to be 50,000*l.*—*Glasgow Chronicle.*

The New Light in the House of Commons.—The House of Commons on Saturday evening, was fully lighted for the first time with Gurney's Bude light, in the presence of several of the Ministers, and of a great number of Members. The light is brought into the House by catoptric, and diffused by dioptic principles, so that while it is exceedingly brilliant and effective, it is soft and pleasant. The lights are placed out of the House above the roof, and being insulated by plate glass, ventilation may be carried upwards or downwards, which is an important point. Of the various media through which the light was diffused, that of the crystal octohedron facets, combined with prisms, seemed to be the most generally admired. We understand that this light, which may be regarded as a new era in the science of illumination, is due to the public spirit of the Elder Brethren of the Trinity House, at whose expense the Bude light has been perfected for the greater security of our merchantmen and navy.—*Globe.*

Calibre of Ships' Guns.—The calibre or caliber of a gun is the diameter of the bore of the barrel, and also the diameter of the shot.

The calibre of an	84	pounder is	10.00 inches.
,,	68	,,	8.05
,,	42	,,	6.84
,,	32	,,	6.41
,,	24	,,	5.82
,,	18	,,	5.29
,,	12	,,	4.62
,,	9	,,	4.20
,,	6	,,	3.66
,,	4	,,	3.20
,,	3	,,	3.11
,,	1	,,	2.01
,,	½	,,	1.80

—*London Saturday Journal.*

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 6, Peterborough-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 823.] SATURDAY, MAY 18, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

CURTIS'S APPARATUS TO PREVENT COLLISION BETWEEN TRAINS ON RAILWAYS.

Fig. 5.

Fig 6.

CURTIS'S PATENT RAILWAY CARRIAGE BREAK, AND APPARATUS TO PREVENT COLLISIONS OF TRAINS ON RAILWAYS.

Mr. H. J. Curtis, of Deptford, in August, 1838, obtained letters patent for "certain improved machinery and apparatus for facilitating travelli transport on railways." The tw trivances, of which the descriptio lowing are extracted from the sp tion, are the most important; the we shall probably take another op nity of making public:—

Fig. 1.

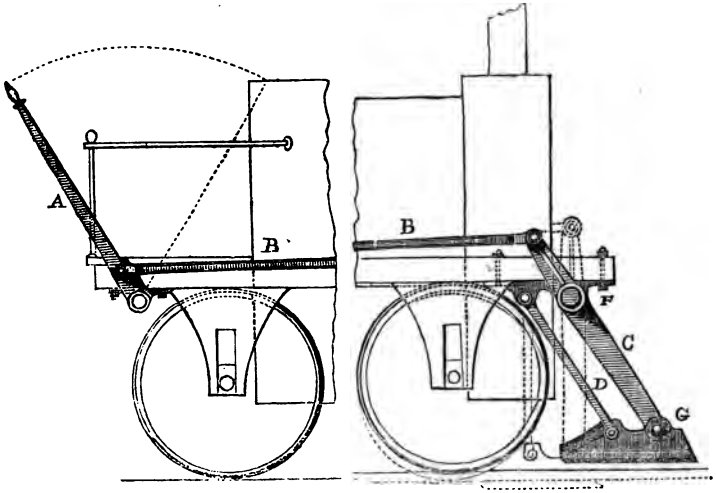


Fig. 2.

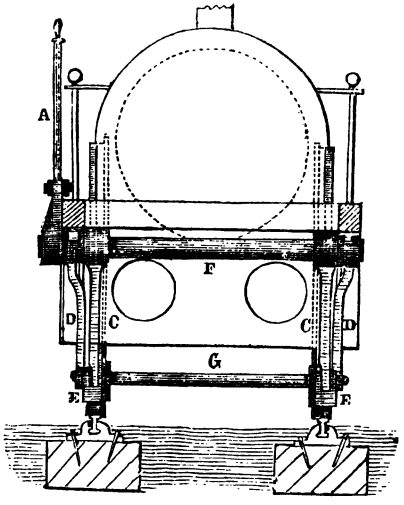


Fig. 3.

Fig. 4.

"*Break or Carriage for arresting the Progress of an Engine or Carriage, and which may also be applied for clearing the Line of impediments placed or lying upon it.*—*The best form of this break is shown in* fig. 1, 2, and 3; fig. 1 is a side vie fig. 2 an end view; it may be placed in front as shown, or behind the or carriage, but I prefer the front engine, because it is made them

as a means of clearing the line, as above stated.

"A shaft, F, is placed across the framing of the engine, and upon this shaft are fixed the two legs or levers, C C, and to the lower ends of the levers are attached the shoes, E E, by the pins of the connecting rod, G; but in cases where the connecting rod, G, would not clear the timbering of the bridges of the line, it may be omitted and the joints made by pins only; the cross-bars may be either omitted or placed higher on the parallel rods, D D, used to keep the lower surfaces of the shoes parallel with the rails, and to give them a certain degree of steadiness; the shoe is formed either of wrought or cast iron, or of timber shod with iron, with a flange upon its inner edge to correspond with the flanges of the wheels; the back end is formed to the curve of the contiguous wheel, so that where it is in gear it impinges against it, and the flange of the wheel enters the grooves formed in the shoe, and thus very materially adds to the stability of the apparatus. The groove is shown clearly in fig. 3, which shows the upper plan of the shoe, and fig. 4 the under side of the same. A rubbing piece of wrought iron or other metal may be introduced into the under side of the shoe, and secured by rivets or other means, which can be renewed as it becomes worn out by the friction of the rails when in contact with them. A crank is fastened upon one end of the cross-shaft, F, to which is connected the rod, B; the other end of this rod is connected with the lever, A, working upon a pivot, by which the engineer can work the break as circumstances may require; the cross-shaft is connected by the carriage to the frame in the usual way, and the pin makes likewise the connexion of the parallel rod, D, at its upper end, and the pin at its lower end; the lever may be substituted by a screw, which may be made to act in a line with the connecting rod, B, for the purpose of working the apparatus, or any other fit and suitable leverage may be adopted. When the engineer observes any thing upon the line he is desirous to remove with the break, he depresses the shoes to within a very short distance of the rail, which distance may be denoted by a stop placed upon an arched segment, against which the lever, A, may work, or by any of the usual means for the same purpose, and when he is desirous to stop the engine he causes the break to come into contact with the rails, by moving the lever, A, further forwards, and if to stop the engine as short as possible, the lever *is thrown forward until it occupies the place shown by the dotted lines, when the apparatus assumes the position also shown by the dotted lines in figure* 1, the effect of which is to raise the engine a space equal to that included between the black and dotted lines.

"The force required on the part of the engineer to produce this effect is very trifling, because the momentum of the engine forces the shoe into gear as soon as it is brought firmly into contact with the rails; the springs, by their re-action, still keep the wheels upon the rails, but the weight being transferred for the most part to the break, the tractive power of the driving wheels is very much reduced, at the same time such an extensive rubbing surface is brought into action that it will be sufficient to bring the engine to a dead stop, although the steam may not be shut off. It is evident, by examining the figures, that any degree of retardation may be produced between that necessary to bring up the engine and that slightly to check its velocity, as in descending inclined planes and by moving the lever more or less forward, and the leverage must be also sufficiently powerful of whatever kind it may be formed, so that the shoes may be drawn out of gear without stopping the engine.

"*Apparatus to prevent Collisions between Trains on the same Line of Rails.*—This apparatus is shown in figures 5 and 6, (see front page) figure 5 is a side view of the apparatus and an engine in contact with it, attached to the last carriage of a train, and figure 6 is a plan of the same.

"The sledge or retarder, A, is formed like a wedge, with its superior end turned up upon the inner side; flanges are formed, so as to keep it upon the rails, the two sides are united together by the cross-bar, J, the plate, K, and the cross pieces, G G, and the sides are set to the same gauge as the rails, so that an engine may run upon it without difficulty to the cross-bar, J; two buffers, D D, are fixed, which correspond with other buffers, I, formed upon the front frame of the engine, so that when the engine comes in contact with the retarder these buffers receive the concussion; the plate K is used in order to unite the sledge as near to the point as possible, and still to allow a free passage to the flanges of the wheels; to the cross pieces G G, the spring pieces, B B, are fixed, which forms shafts for the wheels C C, upon which the apparatus is carried when out of gear; E is a counter-balance weight to counterpoise the weight of the sledge, so that a man can move it along the line like a truck, with great facility; the coupling F is formed for the purpose of connecting the sledge with the train in the usual way, by means of a joint and pin.

"The retarder or apparatus, when out of action, and connected with a train, is

tached to the last carriage, as shown at L; then the sledge rides above the rails, and is suspended by the spring pieces B B; but should an accident happen which would stop the train, one of the conductors immediately detaches the retarder and runs back with it, and places it 500 or 600 yards behind the broken-down train; then, should not the engineer of the following train observe the train before him, and stop his engine, the engine would run into the retarder, which would become a sledge; the driving wheels, if not stopped by the great resistance which would now be opposed to them, would skid round in the retarder, and would have no power to move forwards. No violent concussion would take place, but the engine would slide along a certain short distance in the retarder, when the train would be brought to a stand-still; a hanging frame, K, must be formed from the engine frame, and the buffers usually placed upon the head-board, transferred to the lower frames, or other buffers, I, placed there. As I do not consider it would be the best plan to make the superior end of the retarder, A, so high as to meet the buffers placed on the head-board in the usual manner, the flange of the sledge A may be either continued all along, as drawn, or may be made in detached pieces at certain intervals in the length, as may be found the best. In the case of a swift train overtaking a slow one in a fog or at night, the swift engine would run into the retarder, and the same effect upon the engine and train would be produced as before stated—viz., that it would be brought to a stand, and the only effect produced to the slow train, behind which the retarder was travelling, would be, that it would be torn away from its fastenings; for the purpose, therefore, of meeting a case of this nature, it will be advisable to make the fastenings such, that it may be torn away without the last carriage being subjected to any violent shock, with this view the pin at F may be of oak, or hard wood strong enough to drag the retarder, but sufficiently weak to give way in the case mentioned."

HUTCHISON'S, AND BACON'S GAS BURNERS.

Sir,—A case of considerable importance, as it affects the interests of gas companies and manufacturers of gas machinery, was decided in the Rolls' Court on the 4th instant. The dispute which the Court was called upon to bring to an issue, related to two gas burners, each being the production of two distinct inventors.

It will be in the recollection of many of your readers, that a controversy on the disputed right to those burners appeared in several numbers of the *Mechanics' Magazine* published in 1837. The controversy originated from an unprovoked attack which appeared in No. 720, vol. xxvii, charging Stephen Hutchison, the celebrated engineer, with having unfairly availed himself of "the inventive talent of others," by causing to be manufactured, a burner, which within the last two years has taken precedence of almost all other description of burners. The writer of the attack in question, alleged that Hutchison's invention was an imitation of ano bscure and now obsolete article, which is scarcely known in this part of the kingdom.

The history of the case is briefly thus:—In the year 1829, a Mr. Bacon was induced to believe that he had effected an improvement on the well known "Argand Burner" by contracting its internal cylinder by means of a metal ring. Without making himself acquainted with those principles which philosophy has developed for our guidance in constructing instruments intended to facilitate the transmission of artificial light, this inexperienced innovator upon the famous invention of Argand, hastened to secure a patent right for his burner. Under this legal protection, the article was circulated to a certain extent in the neighbourhood of its birth; but having been found upon trial incapable of producing so perfect a combustion of the illuminating gases as the common Argand, Bacon's contrivance did not experience that patronage which the sanguine anticipation of the inventor led him to hope for; the sale of the burner in consequence became ultimately both precarious and extremely limited. In about five years after the appearance of Bacon's invention, Hutchison's double-coned burner was introduced; and consumers of gas discovering its useful and economical qualities, an extensive demand ensued.

Mr. Bacon and other parties interested in the fate of his patent *attempted* (both in and out of court) to make it appear that they were injured by the celebrity which Hutchison's invention had acquired; it was alleged by Bacon to be

an imitation of his burner, and consequently, an infringement upon his right. Under this delusion a series of most harassing proceedings were carried on during nearly four years against Hutchison and the London Gas Company. These proceedings did not terminate until Saturday last, when the Vice Chancellor gave judgment *with costs* against the plaintiff. The following is a brief report of the case.*

" *Bacon* v. *Spottiswoode*—*Same* v. *Jones*.

" Lord Langdale gave judgment in these two suits, instituted for an injunction against the defendants, to restrain them from selling, using, or manufacturing a gas lamp or burner alleged to be a counterfeit imitation of the plaintiff's patent gas burner. His Lordship said the bill was filed for an injunction and for the consequential accounts. It was an unusual occurrence to bring a case of this kind to a hearing without a previous motion for the Court to grant the injunction ; but, however unusual, the plaintiff was not precluded from seeking for the injunction because he had not applied for it on interlocutory motion. The usual course was to do so, and the Court then had an opportunity of directing such proceedings as were necessary to determine the validity of the patent. If, however, the plaintiff omitted to move at an earlier period, he must at the hearing show that an injunction was not immediately necessary, or that he did not consider it necessary for the protection of his interest ; and he also imposed upon himself the necessity of making out a clear unexceptionable title. It would be very inconvenient if the plaintiff should be permitted to avail himself of doubts which he had himself raised, and to obtain further time to do that which he might have done before. At the hearing of the cause the Court had to look at the facts produced in evidence, not to consider the propriety of a simple injunction, but whether a perpetual injunction should be granted. It was true, that when a patent had been granted, and there had been some enjoyment and exclusive possession, the Court might interpose its injunction without putting the party to establish the validity of his patent by an action at law, but this must depend to a considerable extent upon the circumstances of the case, and on the nature of the defence. The Court was not bound to grant injunctions merely because a patent had been granted and exclusively enjoyed for some time, but at the hearing the plaintiff was to prove his title clearly, and not to reply upon evidence of a *prima facie* title. In this particular case, *having regard to the nature of the patent and specification, and its alleged infringement, and also considering the defence, and all the facts, he thought an injunction would not have been granted, upon the same facts*, if *applied for before the hearing*, without having the validity of the patent previously established by an action at law. The plaintiff had not made out a clear title, and he had, therefore, to consider whether the bill should be retained to give him an opportunity to bring his action ; but he thought not, and the bill must be dismissed with costs."—*May* 9, 1836.

In this affair, the plaintiff having dispensed with the usual course of proceeding prescribed by the Court of Chancery, that is, applying first for injunctions,—and proceeded upon his own responsibility to harass and perplex the gas company's consumers, by threatening circulars,—has suffered for his folly. This system of intimidation was resorted to for the two-fold purpose of gaining popularity for a notoriously objectionable and destructive burner,—and to injure the interests of the defendants by exciting the fears of the consumers by threats of legal consequences.

CLOVIS.

* We have taken the liberty of substituting the report of the case which was published in the *Times* newspaper of the 6th instant for that with which our correspondent *has favoured us*. We have also *omitted a few observations which are* inapplicable. —*Ed. M. M.*

REMARKS ON MR. SANG'S ESSAY, AND ON THE LOSS OF POWER WHEN MOTION IS COMMUNICATED BY A CRANK.

Sir,—Being one of those persons described in Mr. Sang's paper, published at page 57 in your 821st number, who are but " half acquainted with the nature of machinery," and who has hitherto entertained the crude notion that there is an absolute loss of power by making use of that important member in steam machinery, the crank, and wishing to have my ignorance, or, as he softens the word down, indolence, put into a right train on such an important question ; and perceiving that his paper was deserving the notice of being read before a *Scottish Society of Arts*, and published in a Scotch periodical, it struck me that I must have been greatly in error, and I have little doubt many of your readers

(although some of them I admit, certainly, are Mr. Sang's disciples) are, in notions of this matter; it appears to me, however, that the line of argument adopted in that paper is any thing but satisfactory, and if any of your correspondents would kindly explain what appears to be so very contradictory, several of your readers would feel under many obligations for so doing.

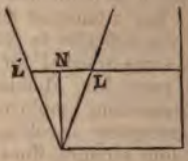
The loss of power by oblique force, Mr. Sang says, he is perpetually reminded of by persons opposed to his views, and he endeavours to remove their objections by reference to the doctrine of virtual velocity, and applying this doctrine to the inclined plane; but appears to be most unhappy in the application in this case; the "weight raised, and the weight which raises it, moves over equal distances, yet both the weights are very unequal." The motion of the weight is here mistaken, he thinks, by those opposed to him for the distance through which its gravitation is overcome; its absolute motion, for its motion in altitude; it is not, however, we who think so, it is himself, for according to his doctrine, the oblique motion should be equally effective with the motion of altitude. How he could overlook such a palpable contradiction appears to be most extraordinary; if there was nothing lost by the oblique direction, why make a distinction between motion in altitude and the motion down the incline? He makes the distinction in the case of the inclined plane, and will not make it in that of the crank where it equally applies. That there is no mistake about his meaning of the word, loss of power, is evident by his comparing the crank and the double rack and pinion piston rod; the former, by its simplicity and convenience alone, being preferred of Mr. Sang's intellectual tools, leads to such strange results; the sooner he throws them aside the better for himself, or make better use of them. If my doctrine be sound, there is not the least danger of the perpetual motion being a natural consequence, for although the power is absolutely lost in the crank to the mechanist, nevertheless it is only dissipated in some other direction, and cannot be made available to him.

I am, Sir, M.

Dublin, 6th May.

ON THE DOCTRINE OF PARALLEL LINES, PARTICULARLY MR. SCOTT'S METHOD.

Sir,—Amongst the many attempts, which during a long course of ages have been made to solve the well-known difficulty in the theory of parallel lines, I am not aware that anything which can be called perfectly satisfactory, and which will bear a close examination, has yet been laid before the public.



In the annexed figure (reduced from one used by Mr. Scott in the *Mechanics' Magazine*, vol. xx, p. 44) A B D is a right angle, C A B acute, and C' A B obtuse. Mr. Scott has shown that if from some point L' in the straight line A C, at a certain height above A, a perpendicular L' L K be drawn to B D the whole, L' K will be greater than A B, while the part L K again will be less than A B. Now, with regard to the proof which Mr. Scott has given of this property, it is particularly to be observed that the greater the obliquity of the angles C' A B, C A B, the greater is the height above A B at which such proof will insure that a perpendicular L' K, or L K may continue to differ from A B. But Mr. Scott, entirely overlooking this circumstance, next proceeds to make N K = A B, and having joined A N, he thence concludes that angle N A B can neither be acute, for then N K behoved to be less than A B, nor obtuse, for then N K would exceed A B. He therefore declares N A B to be a right angle.

Such a conclusion, however, is by no means warranted from anything which has been there established by Mr. Scott. For though he is very careful to impress his readers with the idea that his proof is perfectly general; and although he has proved that at a certain height above A, the perpendicular L' K may, on account of the particular obliquity of the angles C' A B, C A B exceed A B, whilst L K again falls short of it; yet no evidence whatever is afforded that at as great a

height as that of L K above A B, or even at one-tenth as great a height, the like would hold good of a perpendicular drawn to B D from a less oblique line A N. In fact, the only legitimate inference deducible from N K having been made equal to A B, is that angle N A B should be equal to A N K; but since proof is wanting that they are right angles, Mr. Scott's method entirely fails.

In the *Philosophical Magazine* for March, 1822, that able mathematician, Sir James Ivory, has attempted an elegant solution of the difficulty in parallel lines; but in the same Journal for December, of that year, Mr. Meikle has shown that the reasoning employed by Sir James unfortunately involves the assumption that four straight lines may always be made to meet quite around any given polygon, so as completely to inclose it, let it have ever so many sides; which looks exceedingly like the 12th Axiom of Euclid, only in a more complex form, and consequently standing as much in need of proof. As for the celebrated demonstration of this axiom by M. Bertrand, it is highly objectionable; particularly in its requiring no less than infinite lines and infinite areas, which is just running away with the thing altogether. Nor am I much better satisfied with Colonel Thompson's method; but I cannot now enter on so tedious a discussion as an examination of it would lead to.

I. K. L.

May 3rd. 1839.

INSUFFICIENCY OF REWARDS OFFERED BY SOCIETIES TO INVENTORS.

Sir,—The trifling value of the rewards offered for useful mechanical inventions by the London Society of Arts, by the Polytechnic Society of Cornwall, and other Royal Institutions, are ridiculous and even mean, when we consider that the largest portion of the subscribers to those institutions are aristocrats, many of whom care little for spending thousands annually in those most irrational, cruel, and vicious amusements, namely, horse-racing, hunting, and shooting. Vanity alone makes some persons look upon *it as an honour, and feel pleasure at receiving from aristocrats* a paltry copper or silver medal, or a small sum of money. If these societies really wish to encourage inventors, let them give rewards adequate to the value of the invention; or purchase it of the inventor at a fair price; or patent the invention, and let the inventor reap a rich harvest, and thus reward him for his time, trouble, and ingenuity; if the invention is really of value, the inventor would soon be able to repay any expense such society might have been put to; and thus such an impetus would be given to inventors, that perfection in machinery would be arrived at much quicker than it is at present. For want of such an inducement and protection many valuable inventions are lost with the death of the inventors, who during life-time, for want of capital, are unable to bring the invention forward; and from the numerous instances of inventions having been taken from inventors, who have trusted others, dread to put any confidence in man.

I remain, Sir,

Yours faithfully,

ARTHUR TREVELYAN.

Wallington, Newcastle, Tyne,
7th May, 1839.

THE "BRITISH QUEEN."

Sir,—In spite of all "Caledonia's" talk about steamers being fitted out as expeditiously in the Clyde as on any river in the world, the fact of one year being spent in putting in a pair of engines, and having made them too big for the vessel, being obliged to enlarge the engine-room, and in doing this, so straining the vessel, as to be compelled to strengthen her with several additional iron-knees, does not go very far to prove that the owners of their first vessel have gained much by her being sent down to the expeditious Clyde workmen. Our Scotch friend mentions as one cause of the delay, her not being able to be brought alongside Mr. Napier's works, and his having to convey the machinery to some distance from his manufactory. I do not know whether our worthy friend remembers when the *Great Western* was fitted out by the Messrs. Maudsley; if he does, he will perhaps also recollect that during the whole of the time she was in the river Thames, she laid at Blackwall, and

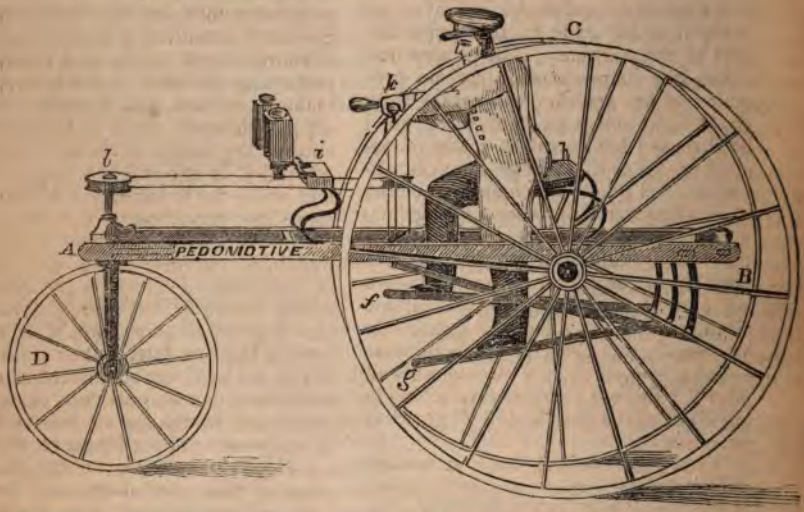
all the world knows that Messrs. Maudsley's manufactory is, and has been for some time past, at Lambeth, some considerable distance from Blackwall. Yet in spite of this mighty disadvantage she was fitted with engines which have already carried her half the world over, without one single accident of any moment, and in an incredibly short time too, and had perhaps quite as much done to her in the way of decoration as the "Queen."

But, I think, Sir, I have already shown enough to prove the folly of the owners sending a vessel hundreds of miles from where she was launched, to be fitted with engines, when comparatively a few yards from Messrs. Curling's, her builders yard, is an engineer's with every facility for bringing a vessel of her dimensions close alongside the works. The Messrs. Seaward, to whom I allude, are too well-known for the superiority of their machinery, and expeditiousness with which they fulfil their contracts, to need any further comment.

I am, Sir,
Yours, &c.,
BOWSPRIT.

Limehouse, May 13, 1839.

MR. R. MERRYWEATHER'S PEDOMOTIVE CARRIAGE.



Sir,—While making some general remarks upon the subject of manumotive and pedomotive carriages, which appeared at page 18 of the present volume, (No. 818), I took occasion to mention a machine of this kind which had been constructed by Mr. Richard Merryweather; it now turns out, that at the time I was writing the article referred to, this party was busily engaged in building a second carriage, in some respects similar to his first. The new carriage has since been launched, and I hasten to lay before your readers a brief description of *its construction, for* the explanation of *which a rough sketch is* annexed; it consists of a strong but light frame AB, mounted on a pair of elegant wheels, six feet in diameter, (C), with a smaller guiding wheel in front, D. The axle of the large wheels is bent into a triple or three-throw crank, beneath which, three treddles, *e f g*, are suspended, one from either crank, the fulcra being placed at the hinder part of the machine.

A seat, *h*, wide enough for two persons to sit side by side, is placed upon springs, just over the cranks; another seat, *i*, furnished with a pair of neat lamps, is placed nearer the fore part of the carriage.

The persons occupying the seat *h*,

cause the progression of the machine, by the impulse of their feet alternately upon the three treddles, one person taking the near side, the other the off side treddle, while the central one is common to both. The party occupying the front seat, *i*, accomplishes the guiding of the apparatus, but if the travellers are only two in number, the right-hand man undertakes the guiding, as well as part of the propelling labour: for which purpose an upright spindle carrying a grooved pulley is furnished with cross-handles at the top, *k*. A similar pulley, *l*, is placed on the top of the guide-wheel shaft, and a strong band, encircling the two pullies, transfers the motion of the handles to the wheel, D. The employment of a band for guiding, does not, however, answer the purpose so effectually as could be wished, and considerable improvement is about to be made in this important part of the machine. The present machine, like its predecessor, can be propelled by one traveller, at a rate of from six to eight miles an hour, if on good level roads; but on rough roads, or ascending hills, the labour becomes excessive. Two persons appear to be the most advantageous load for this machine, a moderate degree of exertion on their parts being sufficient to ensure a very respectable speed, say from ten to twelve miles an hour. Under very favourable circumstances, on a level road, one mile has been accomplished in three minutes —being a speed equal to twenty miles an hour! But such a rate of travelling is quite out of the question for all practical purposes.

It has been asserted that "*on common roads*" the *Aellopodes* "may be propelled at the rate of from *twenty* to *thirty* miles an hour." !!

I presume the word "*common*," means *railroads*, for on nothing else can such a speed be attained; it would be an utter impossibility to *maintain* half thirty miles an hour on any *turnpike-road*.

It has also been stated in several periodicals that Mr. Revis, of Cambridge, has offered his pedomotive carriage (the Aellopodes) to the heads of the Post-office department, with a view to a speedier and more economical transmission of the cross mails—but I trust the heads of the Post-office department are not so heedless as to entertain *such an absurd* and *extravagant proposition*.

I have before stated that, as an amusing and agreeable gymnastic exercise, these machines have a limited range of usefulness, but to imagine they can ever be made extensively or usefully subservient to the purposes of trade or commerce in any shape, is a chimera altogether unworthy of this mechanical age.

I remain, Sir,

Yours respectfully.

WM. BADDELEY.

London, May 3, 1839.

PRESERVING WOOD BY LIME-WATER.

Sir,—I, some years ago (in No. 626), called the attention of the readers of your instructive periodical to Sir Charles Stewart Menteith's (of Closeburn, Dumfrieshire) simple unpatented method of preserving timber; I think it so valuable a process that it cannot be too often published. It is as follows, after cutting the timber to the size it will be wanted, it is steeped in a pond of lime and water for a fortnight, or more or less time, according to the size of the wood. Sir Charles has now some farm buildings on his estate, the timber in the roofs of which is the common young Scotch fir, but having undergone the lime-water process, it is as sound (after a lapse of forty years) as the day it was put up); the same timber, under ordinary circumstances, and in similar situations, would rot in from three to seven years. The carpenters find, in working the wood thus treated, that the edges of their plane-irons soon become dull, on examination, it is found that the acid contained in the wood is crystallized by combining with the alkali of the lime.

Yours faithfully,

ARTHUR TREVELYAN.

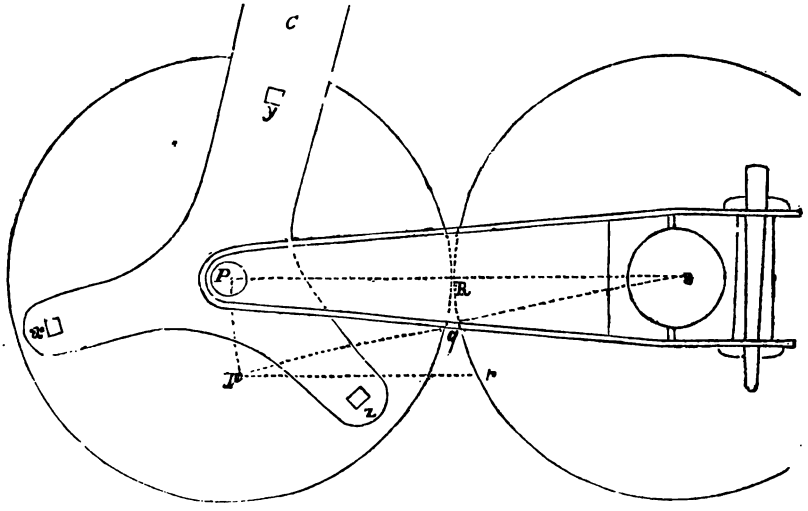
Wallington, Newcastle, Tyne,
7th May, 1839.

THE SUN AND PLANET MOTION.

Sir,—Having observed repeated questions in your valuable work regarding the seemingly paradoxical effect of the sun and planet-wheel motion, I beg to

hand you what appears to me a very simple demonstration of the mystery.

In the annexed diagram the planet-wheel with its centre P, is shown fixed



to the connecting rod C by the bolts *x*, *y*, and *z*, and the link P R S is what is usually applied to keep the planet-wheel in gear with the sun-wheel, whose centre is S; these two wheels being locked together by teeth, suppose that by the action of the connecting rod, the centre P is made to descend to *p* through a space of six inches, it is clear that the point R of the same wheel must also descend to *r*; and since the wheels are locked together by teeth, the circumference of the *sun*-wheel must also be moved through the same space R *r* = P *p* = six inches. But a point R in the radiating link P R S, can only have moved in the same time to *q*, or through half of the space R *r*, and this link makes one revolution in the same time as the wheel P. Hence the sun-wheel S must make two complete revolutions in that time. The two wheels being as usual of equal diameter.

Yours respectfully,

READER.

London, April 26th, 1839.

THE LONDON FIRE BRIGADE.

Sir,—In his last communication Mr. Baddeley complains, with the appearance at least of gravity, that Aquarius "continues to assert, without foundation, and without the slightest semblance of proof," charges of incorrectness and inconsistency on his part, with respect to the system of fire insurance. That these charges have been made is indeed most true, but that they have been made without foundation I take the liberty to deny, especially as I shall be able to produce pretty strong proofs to the contrary before I conclude, though I shall have occasion to resort to nothing more inaccessible than the pages of the *Mechanics' Magazine*, and to nothing less exceptionable than the words of Mr. Baddeley himself.

The charge of incorrectness is easily substantiated by a simple reference to one of Mr. B.'s most recent letters,* the chief purpose of which is to rescue the Fire Brigade from the imputation of inefficiency, by asserting that the reports furnished by himself of London fires in 1830, 1831, and 1832, were so incorrect, that the very idea of depending upon them was ridiculous—so ridiculous, that, as he triumphantly observed, he "*should like to know* what *sort* of a fire-report he could have drawn up for 1838," had his "sources of information" been no better than those of HIS OWN reports for the former years. "Incorrectness!" Why, in the letter referred to, Mr. B. absolutely revels with delight in the excessive incorrectness of his old statements; and incorrect

* *Mechanics' Magazine*, March 30, 1839, vol. xxx, p. 451.

ust have been with a vengeance, since
called upon to believe, that had they
y way accurate, the serious fires of
ould have been found pretty nearly
ice those of 1838, notwithstanding
parity at present shown is no less
iat between *fifty-six* (Report for
and *one hundred and eighty-five !*
; for 1838.†) But the whole of this
ust be too fresh in the recollection of
aders to need dwelling upon; the
it part of it all is, the *naiveté* of Mr.
y in complaining of an attack on his
on for correctness, so soon after he
unteered to sneer at his own preten-
the possession of such an article.
harge of " inconsistency" is not so
ide out. There is no knowing where
, nor how to do justice to so rich a
within the compass of a column or
the Magazine. On the insurance
from the most general view of its
nd tendency down to the minutest
Mr. Baddeley has shown the very
of self-contradiction; he has been
consistent in nothing but his inconsistency. The subject seems naturally to lead him that way, even in irrelevant matters; thus, he commences his last letter by belabouring Aquarius for opening *his* previous communication with a song, in which he only followed suit to Mr. Baddeley, and dexterously hints at the supposed connexion between punsters and pickpockets, immediately after cracking a desperate pun of his own. Surely

" There's fate in this, could we but find it out !"

But a truce to preliminaries, and let us come to the proof at once, in which it behoves us to be brief, our case is so crammed with evidence. To begin, let us adduce once more an instance from the very last Report, which has been before brought forward, but must somehow have escaped Mr. Baddeley's attention, as he has made no attempt to reconcile the discrepancy. The method of printing in opposite columns will best suit the circumstances of the case; the words quoted in both columns are all *Mr. Baddeley's own* :—

fire completes the list of total losses, and *it as has seldom before occurred.*"—*Mechanics' Magazine*, vol. xxx. p. 312.

" Under the protection of the present highly efficient Fire Establishment, the comparative security of lives and property is so much *increased*, as to become the subject of general remark."—*Mechanics' Magazine*, vol. xxx. p. 319.

ange time indeed for such a remark
ne general, especially when it is re-
ed that the Royal Exchange was ly-
omplete ruin at the same time, in
ion of the high efficiency of the Bri-
But it may be imagined, perhaps,
hough this particular year may have
tile in " total losses" and extensive
s, the preceding ones may have pre-
quite a different picture. No such *Before* the setting up of the Fire
, indeed, Mr. Baddeley was enabled
m us that—

he last three or four years, the number of
been gradually decreasing, and not only
umber been diminished, but the extent of
agrations has also been, upon an average,
s limited than formerly. During the last
e were not above half a dozen fires of any
ble magnitude."—(Report for 1832, vol.
67.)

Baddeley has never had the opportu-
making use of such language as this
e *Brigade commenced operations;* Mr. Baddeley has never let slip an
of lauding the " success" of the

ough the aggregate number of fires for the
ended does not *greatly exceed* that of
amount of property destroyed has been
ater, from the circumstance of many of the
urring in the largest class of buildings, such
ive warehouses, or manufactories, or the
ol. xxii. p. 349.

Brigade's exertions, and of leading the unexamining to believe, as they might from the second of the above extracts, that the security of lives and property had really increased, instead of the contrary. In 1833, the first year of the Brigade, although Mr. B. commenced his report by premising that fires had been unusually numerous, and although it appeared from his statement of numbers, that the serious fires had tripled those of the preceding year, he indulged in considerable laudation of the " corps," and pronounced that their " success had been greater than *could have been anticipated !*" —(vol. xx. p. 276.) Pretty well for a beginning!

The next year, however, affords him the widest scope for his encomiums. The Houses of Lords and Commons lay, a heap of blackened ruins, a splendid testimony to the merits of the new system. Nor was this all: fires altogether had increased, both in number and dimensions. Can we wonder, then, at having it in our power to confront such extracts as the following?—

" The London Fire Establishment continues steadily to *improve* (!) and its *advantages* begin to be better understood, and more fully appreciated, by the public at large, * * * The skilful management of Mr. Braidwood has given such effect to the force under his command, as to render far more efficient protection to lives and property than could possibly be accomplished by the more numerous independent bodies on whom this duty formerly devolved."—vol. xxii. p. 355.

* *Mechanics' Magazine*, vol. xviii. p. 266. † *Ibid.* vol. xxx. p. 306.

What next? Why, if the Brigade had been established in 1666, and Mr. Baddeley had had the writing of a Fire Report for that year, he would assuredly never have been able to contain his raptures. In fact, he commences his next Report with a quotation from a *poet of that time* (Dryden), and goes on to remark (by way of drawing attention to the merits of his beloved Brigade) that, as to London fires, "neither are their numbers smaller, nor their terrors less, than in the times in which he lived." Nor is he without foundation for his assertion, as will be seen from the first of the confronted quotations below:—

"In proof of this, I need only refer to the long and melancholy catalogue of accidents detailed below, premising that during the year which has just closed upon us, fires have been very numerous, many of them of fearful extent, and several attended with a melancholy loss of human life."—vol. xxiv. p. 354.

"Its progress (that of the Brigade) has been such as to realise the best expectations of its founders, and has fully demonstrated its importance in a public point of view, as well as its great practical utility. The immense *advantages* of the united system, during its brief career, must have been strikingly apparent to every attentive observer." (!!) —vol. xxiv. p. 364.

The next Report is ushered in with the usual intimation of the increase of fires, and the body of it is occupied with the details of two of first-rate importance, on account of the unchecked ravages of the flames. Of course, also, Mr. Baddeley's usual testimony is not wanting:—

"This (the fire at London Bridge) was the most tremendous conflagration I ever witnessed; indeed it is said, and I believe truly, to have been the largest fire with which the metropolis has been visited since the dreadful fire at Ratcliffe in 1794, and may it be long ere we witness such another."—vol. xxvi. p. 358.

"Having for fourteen years attentively watched the progress of the firemen under the old state of things, and for four years the results of the united system, I have no hesitation in most positively asserting, that both the Insurance Companies and the public generally are gainers by the change."—vol. xxvi. p. 364.

Singular, indeed, that, under these circumstances, the Brigade should, in their fourth year, have the honour of a fire more extensive than the "old firemen" could boast of for the last forty years of their existence!

And how comes it that Mr. Baddeley is always most enthusiastic in his praises, in proportion to the wide spread of calamity by fire? We have seen that he never fails to accompany every more than usually appalling detail by reiterated eulogies on his protegés. To account for this, recourse has been had to a communication of Mr. B.'s, which certainly harmonizes wonderfully with the hypothesis that he considers a good fire a good thing, to wit:—

"The following fires of very serious magnitude have occurred in London within the last five years, viz.:—
1834, October 16. Houses of Lords and Commons.
1835, March 2. Silver-street, Golden-square.
1836, March 26. Western Exchange, and Burlington Arcade.
1836, August 30. Fenning's Wharf.
1837, December 28. Davis's Wharf.
1838, January 10. Royal Exchange."
—vol. xxx. p. 42.

"*Against which*, I believe, the Parisians can set nothing beyond the 'Theatre Italia' in January last.
"Whenever a comparison has been made, in my hearing, between the promptness, skill, and intrepidity of the London and Parisian firemen, it has always been to the advantage of the former; a *glance at the foregoing elements will show the fairness of the conclusion.*—vol. xxx. same page.

Estimated in this way, the services of the Brigade may well be estimated highly above those of their predecessors: but how is this mode of appreciation to be reconciled with the assertions hazarded as to the "increased" protection of property? If Mr. Baddeley had informed us that, "under the present highly *deficient* system, the increased *destruction* of lives and property had become the subject of general remark," all would have been well; the observation would have tallied exactly with what he had said as to the Parisian firemen; the intent of his praises of the Brigade would have been obvious; and, above every thing, his "consistency" would have been preserved in the eyes of the world. The Brigade may well bear out his warmest panegyrics, seeing that they can not only show half a dozen serious fires for one with the *sapeurs-pompiers* of Paris, but can produce considerably more than two for one, when compared with the old disunited firemen *of their own district!*

That the Brigade system, estimated in the more usual way, as a suppressing force, has been a failure, the extracts above given are in themselves sufficient to show. Mr. Baddeley alleges that I accuse them of "culpable inefficiency;" this I deny, and dare him to the proof. There seems little need of going farther for the secret of their great want of success, when the fact is made known that the whole force consists of "something less than one hundred men," divided over an immense mass of buildings like the metropolis, eight miles in length, by two, three, and four in breadth! The idea of anything like proper

protection to either life or property being afforded by such a slender provision as this is absurd on the face of it, and the facts adduced by Mr. Baddeley in extenuation of some of their failures, confirm the view which every impartial observer must take. Thus we are told, that while the Royal Exchange was burning, a part of the force was absent at a fire at Chelsea. This is an excuse for the firemen, but none at all for those who maintain the "highest possible protection" theory. In such a place as London, two fires may often be expected to break out at once—or even more,—but to how helpless a state does such an occurrence reduce so slender a body as the brigade? Again, we are assured that all the numerous fatal cases of last year were consummated *before the arrival of the firemen on the spot;* a tolerably plain proof of the frequent inability of the brigade to render that *timely* assistance which such cases invariably require.

These consequences, lamentable as they are, were foreseen and deprecated;—and by whom? By Mr. Baddeley! We have seen how often he speaks of the "anticipations" formed of the brigade being "realized"; let us see what these anticipations were, premising that, previous to the formal establishment of the brigade, a considerable approach to the same economical system of retrenchment and co-operation had been essayed by some of the Insurance Companies. On this, Mr. B. published the following well-grounded remarks, every one of which, it will be perceived, is perfectly applicable to the present state of things:—

"Some of the oldest Insurance Companies have formed a sort of union, or alliance, by which they mutually agree to aid and assist each other, thereby *reducing the number of engines and firemen* necessary to be kept by each. This, the co-operative system, works exceedingly well for the Insurance Companies, but is not equally advantageous to the public, seeing that the chance of prompt and effectual assistance, in case of accident, will *always* be in proportion to *the number of men and engines that are distributed over the metropolis.*"—vol. xvi., p. 311.

"The public will not, as P. R. states, 'be led to *suspect,*' but, if they view the case aright, they will positively know that it is not to the Insurance Companies' interest that property should be secured against calamity by fire '(*at their expense*) beyond a certain extent':—that is, beyond the extent of their own liability."—vol. xxvi., p. 158.

"Let the *public* take what share of the risk they please, but let them protect that share as well as the Insurance Companies protect theirs, and *we shall hear but little complaint about the spread of fires in future.*"—vol. xxx., p. 159.

We have seen, by the increasing number of serious and fatal fires, that the apprehensions here expressed have been verified to the very letter; yet, will it be believed, the writer of these remarks has taken every opportunity of repudiating them, and the more so, the more they have been proved by actual fact to be correct and sound! In the above passage, Mr. Baddeley distinctly recognizes the proposition for which I contend, and which seems too evident to need much demonstration,—that the interest of the public and of the Insurance Companies in fire-extinction, is not by any means the same. I have observed that "the pivot" on which the discussion hinges, is simply this, "*that it is not to the interest of the Insurance Companies to establish a fire-extinguishing system of the highest degree of efficiency,*" and by this proposition I am quite ready to stand or fall. Strange to say, upon this point Mr. Baddeley has exhibited (if possible) a greater degree of "inconsistency" than on any other. At one time he has laid down the law almost exactly as I have just stated it, while at others he has asserted directly the reverse; witness the following extracts:—

"Every nerve has been strained to render the Fire Engine Establishment as efficient as possible."—vol. xxvi., p. 227.

"The *uninsured*, the insured, as well as the insurers, all *equally* receive the *greatest possible* protection"!!—vol. xxx., p. 364.

Surely, "the force of contradiction can no further go."—I may well stop here and give time to Mr. Baddeley to vindicate his consistency on this, the most essential feature of the whole discussion, before adducing any longer list of his points of inconsistency; *certes*, there is no need to pause for want of material, as I find I have not yet noticed one half the instances of glaring inconsistency I intended to call attention to when I began these remarks, and that, should I copy them all, with but a brief comment upon each, something like a whole number *of the Mechanics' Magazine* would be required to contain them;—and I am afraid, as it is, this communication has extended to quite as great a length as can be afforded to the subject. I shall, therefore, leave Mr. Baddeley to his cogitations, and your readers to judge between us on this question (?) of "inconsistency," upon the evidence already brought forward; only observing, that I hold myself in readiness to produce as many more point-blank instances of self-contradiction on his part, if required, either before or after he shall have digested the specimens given on the present occasion.

There are one or two matters in Mr. Baddeley's last letter, on which I intended to say a few words,—and a very few words they now must be. One of these was the "showiness" of the Brigade's appointments. Mr. Baddeley appears to have overlooked just one half of the strictures I made on this head. I charged the Insurance Companies with "making as great a show as possible *at the lowest possible cost.*" This latter part it is that Mr. B. has missed. Nobody doubts that the old firemen's dresses were showy enough, and that everything was conducted with a view to excite attention in their days. The constitution of the Insurance Companies then was the same as now, and their objects (display the chief one) just the same. Under the old competitive system, however, rigid economy was not the order of the day; the "number of men and engines" was far greater than are now employed; and the result evidently was, (in conformity with Mr. Baddeley's opinion, vol. xvi., p. 311, before quoted) that "the chance of prompt and effectual assistance was much greater" than it has ever been since the Fire Brigade's establishment. Mr. Baddeley has brought forward in proof of the efficiency of the latter, the fact that all the fire-offices (except one) have joined it;—a proof indeed, of its efficiency for their purposes, but none at all of its utility to that very differently-circumstanced body, "the public." The Brigade is well "got up" in all that respects display, and with every regard to economy at the same time. More "stage-effect" probably is produced by the cheap "dark grey uniform" of the Brigade, with those well-imagined "properties," the chivalric *morion*, or helmet, and terrific *tomahawk*, than by all the expensive "bright-blue Brummagems" of the old firemen. In this point of view the "high efficiency" of the establishment is unquestionable.

In conclusion, I trust Mr. Baddeley will pardon my want of the qualification of a twenty years' attendance at fires, on the strength of my having advanced no fact whatever without its being backed by the testimony of a person *as experienced as himself:* and, if it be not considered too inquisitive, I should be glad to know whether it is on fires alone that anonymous correspondence is considered a "disgrace," or whether the subject of *locks* is equally prohibited to a masked writer? Will Mr. "B. B." be so good as to read me this *Riddle?*

I remain, Sir,
Very respectfully yours,
AQUARIUS.

London, May 11, 1839.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal* for Jan. 1839.]

IMPROVED TRAP FOR RATS AND OTHER ANIMALS, *Thomas Hill, Alexandria.*—This trap is arranged with much ingenuity, but whether the wary animals for whose accommodation it is principally intended, will be inclined to examine its interior is a question to be decided by experience. It has several compartments, the first of which has a sliding door, which rises and falls in the manner frequently adopted in traps; within this first compartment the bait is placed upon a hook, by the moving of which the front door falls; but the same action opens a passage into a second compartment, the floor of which is a moveable platform, or drawbridge, by stepping on which the opening into this second compartment is closed, whilst the first slide is raised, and the trap reset. A conical opening of pointed wires, or a sloping fall door allows the rat to advance into a third compartment, leaving the former free for new applicants, and to this third, is attached a fourth compartment, or grand saloon, which may be removed at pleasure, with the animals which may have entered it.

FURNACE AND POTS FOR MELTING METALS, *Silas Grilley, Connecticut.*—The furnace may be round or square, and of a size suitable for the pots intended to be used, and must be lined with fire brick, or other material indestructible by fire, and having a grate at the bottom, the middle bar of which should have on it an elevated stand about an inch high, for the pot to rest upon.

The pots may be of any size, and for large or small operations, and are in the common form, except that they should be made without a projecting lip, and of the materials in common use, or of any other that will stand the fire; the improvement consists, principally, in placing on the melting pots, a top pot, or tube, open at both ends, about one-fourth longer than the bottom pot—in diameter, of the size of the lower pot where they join, and a little less at top, having a shoulder with a lip at the bottom, to fit, embrace, and rest upon the top of the lower pot, and is made of the same materials as the lower pot.

The object and peculiar use of the top pot, or tube, is to enable the operator to charge both pots with metal sufficient, when fused, to fill the lower pot as it melts and descends; thus preventing the necessity of opening the furnace to introduce cold metal, and the waste of time occasioned thereby; and while the fuel in the furnace surrounds both pots on the outside, all coal may be excluded from the inside of both.

The furnace may be covered with folding doors, closing around the upper pot, or tube, or it may be held steady in place, by a ring around the tube, having branches hooked to the sides of the furnace. The top of the tube may be covered with a moveable lid, to exclude coal when feeding the furnace.

The object is to confine the heat, and to give easy and direct access to the lower pot for the occasional supply of metal when necessary for compounding, or otherwise, without interfering with the fuel, and to prevent the waste of metal by such interference, and the loss of time and labour by the usual mode of feeding.

After the metal is all fused, the top pot, or tube, may be taken off, and a flaring piece, or hopper, having an open orifice in the centre, of the size of the melting pot, made of the same materials as the pots, and fitted with a lip, to the top of the lower pot, and flaring upwards nearly to the sides of the furnace, may be placed upon the top of the pot, thereby confining the heat around the pot, and preventing the loss of metal by washing, while stirring the melted mass to mix and amalgamate the metal—a necessary operation, and often attended with loss.

SHOT CHARGER, FOR MEASURING SHOT IN CHARGING GUNS, *George W. Dobbins, Baltimore.*—The claim made is to a "mode of measuring the charge in such way that all except the quantity requisite to constitute the charge shall run off and be separated from the charge; and the mode described of discharging the shot at once into the barrel of the gun, in connexion with the application of the principle above mentioned."

The plan is simple, and must answer the purpose intended. The shot bag fills the charging tube, as it hangs over the shoulder, the shot running into it through a lateral tube leading from that forming the mouth of the bag. When the shot bag is turned up for the purpose of charging, all the superfluous shot runs back into it by the same opening through which it entered; that constituting the charge remaining in a chamber below the opening; when the mouth of the charger is placed over the muzzle of the gun, and a valve opened by a thumb piece, the shot will fall into the gun by their own gravity. The instrument is made adjustable.

ROYAL INSTITUTION.—JOINING SHEETS OF PAPER.—ANCIENT SCULPTURE IN IVORY. —THE TURK'S HEAD. — *MR. SOLLY'S LECTURE ON THE STRUCTURE OF BIRDS.*

May 3.— The Conversazione. — Though many curiosities were placed on the table this evening, including bitumen and fossils from the Dead Sea, there was nothing requiring particular notice, except it may be for its utility, the mode of joining sheets of paper together, exhibited by Mr. Cowper, by which the puckering that is occasioned by paste or glue, or any watery solution, is avoided, and a very neat joint is produced. The cement used is a thick solution of caoutchouc, which being applied to the edges of the paper, is allowed a little time to dry and get sticky before the sheets are joined together. This expedient will be found very useful to the lecturer and the draftsman.

Our attention was attracted by a most exquisite carving in ivory by one of the old masters, sent by Mr. Hemming. The spirit and freedom displayed in this beautiful composition could not, in the first instance, have been slowly elaborated in an intractable material like ivory, but must have been struck out in some plastic substance, as wax or clay, and then copied with a more careful attention to the minute details. This we think was the general practice.

There was also exhibited, on this occasion, an illustration of that curious mechanical puzzle which is to be seen at the Adelaide Gallery, of a Turk's head, which, on a sword being passed through the neck, is not severed from the shoulders. This very clever, yet simple contrivance, has been a wonder to thousands, both among the wise and the simple, and a never-failing source of pleasing interest on account of the intense curiosity which it is capable of exciting; but the charm is nearly dissolved, and the spell of enchantment which happy ignorance and its own mysterious nature combined to throw around it, is well nigh broken, for many were tempted on this occasion to accept and eat of the fruit of the tree of knowledge, and now their eyes are opened. We, however, will not be the means of beguiling others—we decline being a party to this Eve-like procedure, for in such a case, when "ignorance is bliss," or at least the occasion of it, we think it quite as well not to make every body as wise "as one of us." If we had had the inclination, it was in our power to have done so twelve years ago (and we were solicited for that purpose with a view to its publication), for about that period has elapsed since it was proposed to us as a mechanical problem by its inventor, Mr. Lukins of Philadelphia, and for the second time in this country, received its solution. Soon afterwards it was taken abroad by two friends of ours, one of whom having allowed it to go out of his possession for a short time, the secret became known, and after a while it spread over the Continent, when, as we understand, the nor cutting-off-head has now become a comm

article of sale. The head in the Adelaide gallery, which is on a scale as large as life, and has an additional contrivance for moving the eyes, was made by the ingenious Mr. Saxton, a countryman of Mr. Lukin's. It was at one time the intention of the Directors of that Institution, to publish the nature of the invention, through the medium of their journal, *The Magazine of Popular Science*, but influenced by the same motives which have actuated us, they very properly abandoned it. The suppositions that are generally made in regard to the contrivance, as consisting in magnetism, or in a succession of spring catches, which on the knife passing them, revert back to their former position, are altogether erroneous. We will only say, that it is a lock, which never unlocks, although the key (the knife) never fails to pass the wards and move the bolt.

The Lecture.—Mr. S. Solly lectured "on the structure of birds, in relation to their habits of life and position in the animal kingdom." It does not fall within our plan to offer any report of such a lecture as this, for our aim from the first has been to give the spirit and point of a lecturer's subject, and not to follow literally the lecture itself—to present its general scope and design, and not a synopsis of its contents. But such a theme as that just recited, necessarily requires for its illustration and its subject matter, a body of particular information, and devoid of any general bearing or convergence towards a given ultimate point; we should therefore have nothing to report but a mass of details, to present an abstract of which, besides being foreign to our purpose, would, to speak in the language of the subject, be offering a dry bony skeleton deprived of all that filling up of flesh and substance which made it interesting and instructive to the audience, and which alone would render it deserving the attention of the reader. We are, however, bound to state that the lecture was ably given, and exceedingly well illustrated with diagrams and suitable subjects from among the feathered race.

NOTES AND NOTICES.

Smoke Consuming Furnaces.—Sir,—I find described in your valuable journal, vol. ii, p. 250 (1823), a Smoke Consuming Furnace, by Parkes; a modification of the same principle was afterwards patented by Witty, described in vol. viii, p. 338.—"Rodda's patent method of consuming smoke," noticed in No. 820, p. 64, vol. xxxi, is another modification of the same. In vol. v, p. 60 (1826), there is an account of a method of destroying smoke by a jet of steam, taken from a paragraph in the Birmingham Chronicle. Iveson's patent method described in vol. xxix, p. 403 (1838), is exactly similar.

Safety Bulk-head Ships.—At the meeting of the British Association at Liverpool in 1837 (on the Friday), a Mr. Williams proposed to employ safet bulk-heads for steam vessels, &c. Many persons think the idea is new, but on referring to vol. v, p. 83 (1826), of your journal, they will find the same plan proposed, taken from a paragraph in the *British Mirror* which paper found an account of it in the *British Observer*, many years ago.

Spirit Gas Lamps.—In my notice of Spirit Gas Lamps in vol. xxx, p. 90, of your journal, I mentioned that the spirit employed had a strong smell of spirit of turpentine, I have since found, in one of the early volumes of your journal, an Illuminating Spirit for Lamps, composed of spirit turpentine 1 part, alcohol 7 parts. The carbon of the turpentine renders the alcohol luminous.

I remain, Sir, ARTHUR TREVELYAN.

Steam-boat Tillers.—The use of wire tiller ropes for steering steam-boats is becoming general on the western waters. They answer admirably for the purpose intended.—*American Mechanic and Farmer.*

Resin of Benzoin.—M. Berzelius has asserted that the resin of benzoin, on distillation, furnishes an oil, which, like that of bitter almonds, is, by long contact with the air, converted into benzoic acid. Since then, Mr. Fréney has shown, that this oil is changed into benzoic acid under the influence of potass. M. Auguste Cahours has been making further experiments with the following results: in a pure state this oil is limpid, colourless, a little soluble in water, to which it communicates its odour and its flavour: it is soluble in alcohol and ether in every proportion; its odour is sweet and aromatic, its flavour acrid and burning, its specific gravity greater than that of water, and it boils at about 205°.—*Athenæum.*

Photogenic Drawing. — Considering that any (however trifling) improvement will not be unacceptable to those of your readers who feel an interest in this art, I have been induced to communicate the following method of preparing the paper, which, after many experiments, I find to succeed best. Wash the paper with a mixture of equal parts of the *white of egg* and *water*, afterwards with the solution of nitrate of silver, fixing the drawing as usual with the iodide of potassium.—H. L.—*Ib.*

Mineral.—A mineral found at Berneau, near Visé, in the province of Liege, furnishes the following analysis:—

Ferric oxide.....	0.4015
Phosphoric acid.....	0.1831
Water	0.4154

it therefore presents a different composition from that of all the phosphates of iron hitherto examined.—*Ib.*

Erratum. — In the account of Boomarang in No. 796, p. 90, 1, 2, in first column "1½ inch thick," ought to be "½ inch thick."

Wood-engraving Machine.—The practice of engraving the outlines and rivers on wood, and then piercing the block and inserting the names of the places in type, has lately been revived; and where publishers are obliged either to print maps with the type, or to give none at all, this mode may answer very well, more especially when the object is to give the relative position of a few of the principal places, rather than a crowded list of names. Most of the larger maps in the *Penny Cyclopædia* are executed in this manner. The holes in the blocks are pierced with the greatest rapidity by gouges of different sizes acting vertically, and put in motion by machinery contrived by Mr. Edward Cowper, to whose great mechanical skill the art of steam-printing chiefly owes its perfection.—*Jackson's Treatise on Wood-engraving.*

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 6, Peterborough-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 824.] SATURDAY, MAY 25, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

ADAMS'S PATENT VERTEBRATED TRAIN-CARRIAGES FOR RAILWAYS.

Fig. 1.

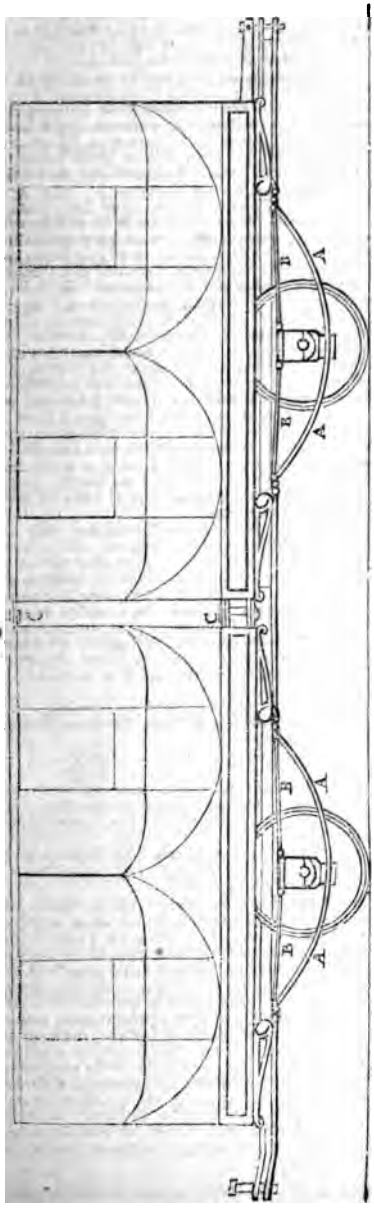
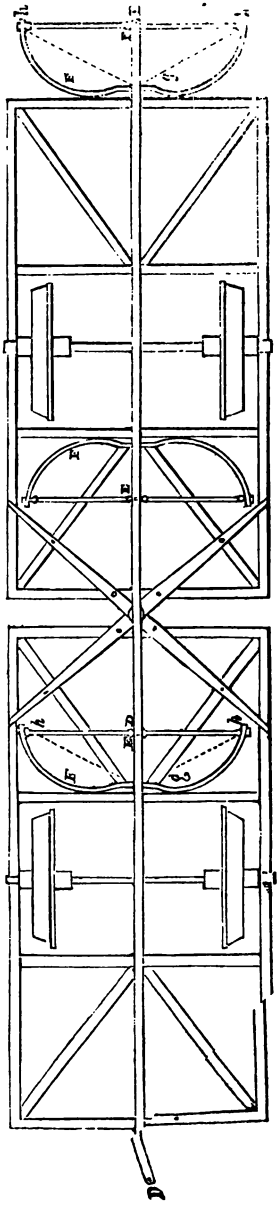


Fig. 2.



ADAMS'S PATENT VERTEBRATED RAILWAY TRAIN OF BOW-SPRING CARRIAGES.

In reviewing Mr. Adams's work on "Pleasure Carriages," in our twenty-seventh volume, we referred to this gentleman's invention of a new coach spring, similar to an archer's bow, and to the various remarks and suggestions he made on the construction of railways, and the adaptation of his various vehicular inventions to railway purposes. The merits of the new spring, as applied to common road carriages, have, we understand, stood well the test of experience. Upon this point we were favoured by Mr. Adams with some statements of their operation, which were published in our 28th volume, p. 268. We have now more particularly to call the attention of our readers to the railway branch of Mr. Adams's projects—the adaptation of the bow springs to the railway train, in connecting the carriages, and in suspending them; and to a train so formed Mr. Adams has given the name of a *vertebrated* train, from the resemblance which he desires it to have in strength and flexibility to the back-bone of an animal.

The engravings on our front page are plans and elevations of two carriages; the plan principally showing the mode of their connection, and the elevation, of their suspension to the axletrees. In figure 1, A A A A, are the bow springs supporting the carriage, with a double action; B B B B, lever-links (the string of the bow) acting on the bow springs, and which would serve to suspend the carriage if the springs were removed. C C are vertical joints, permitting a lateral bend in the train of carriages when passing round curves on the line of road.

In figure 2, D D is the traction rod, made either of wood or iron, connecting the carriages and springs. One end is fixed to the carriage, and the other to the lever-links, or string E E E, of the horizontal bow springs, F F F. The back of the bow spring is made of a singlebar of well tempered steel; and the *string*, or what may be so considered, consists of two equal lengths of single bar steel, or prepared tempen cord, the inner ends of which are linked to the body or frame of the carriage. As the two straight links forming the string play as well forwards as backwards, they serve to prevent any longitudinal concussion, whether the engine be drawing or propelling, or whether the carriages continue moving in one direction or are brought suddenly to a stand. They do not play (independently of the carriage) from side to side; and therein consists a great excellence, since they thereby help to give lateral firmness to the whole locomotive frame, and to keep it steadily in the line of motion.

The action of the springs hardly requires explanation. When the train is in motion, the point of connection of the links, or centre of the string, is forced to *g*, as shown by the dotted lines in figure 2, and the two points of the spring or bow to *h h*; the traction rod will bear firmly against the adjoining carriage. The strength of the spring and links may be made proportionate to the weight of the carriage to which they are applied, consideration being had to the kind of work to be done, and the quality of the road to travel.

The invention, we are informed, is in action upon the London and Birmingham Railway, and we hope shortly to have to report favourably of its operation.

THAMES AND CLYDE-BUILT ENGINES —CONSTRUCTION OF STEAM VESSELS.

Sir,—It is stated in the logs of the first voyage of the *Great Western* across the Atlantic, that she arrived at London on the 22nd of May, 1837, and that the first trial of her engines took place on the 26th of March, 1838. Whether four months only out of the seven, the period of stay in the river, were employed in fitting the engines, is not clear; such might have been the fact, as a delay until April was obviously an advisable proceeding, for the purpose of avoiding a winter's passage in the first attempt to cross the Atlantic entirely by steam.

It appears time for the owners at least, to enquire, "What has become of the *British Queen?*" Previous however to the admission of the superiority of London engines, persons interested neither in them, nor in the Scotch engines, may perhaps be permitted to ask in what manner the asserted superiority has been proved?

The *Atalanta* and *Berenice* were sent to India, one with Thames, the other with Clyde-made engines; and, as far as the published logs afford evidence, no very decisive opinion can be formed; but imperfect as such evidence must be, from a single long voyage, yet it does not support the asserted claim of London superiority: a long average of several engines, under similar conditions in equal vessels, will be required for the determination of a point involving such important interests.

Tables containing the prices of the engines, the miles run, consumption of coal, speed, and divers other particulars, would be of more value than general assertions on either side, or opinions drawn from the acts of London and Bristol steam boat companies. The rivalry of north and south country engines will prove of great service in calling the attention of steam boat companies to the best tests of comparative merits, and whether the superiority in each case is due to the vessel or engines, or to the good engineering arrangements by which they are suited to each other: in the same manner, the puffs of the superiority of iron over wood in the construction of steam boats, will become of even greater value by attracting attention to the common methods of ship-building as compared with Sir Robert Sepping's plan, or that employed by Mr. Laing in the *Ruby* and other Gravesend steamers.

This vessel, which seems to have just claims to be considered the fastest steam boat in England, is built of several series of oak planks, forming a solid side and bottom of equal thickness and strength, like John's launches in Her Majesty's service, about two-fifths of the usual weight, and of almost incalculable greater strength.

Some years ago, a vessel called, I believe, the *Rochester*, of 500 tons, built of a larger number of thinner plank, went on shore with ordnance stores on board, at Mount Batten, in Plymouth Sound, in company with ten or twelve other vessels, in a gale, and was got off with a hole in her bottom, which was repaired, while her companions were entirely wrecked.

These rocks afforded favourable conditions for testing the relative strength of vessels.

Portions of Sepping's plans have sometimes been adopted in merchant steamers, though seldom in sailing vessels, except in those built for the navy.

Iron craft, I trust, will lead to the improved construction of vessels of wood; the latter, when properly used, will, I am convinced, prove as superior to iron, as iron is now superior to timber vessels of the common method of construction. The continuation of defective and weak methods in ship-building is due to many causes; among others, to the facility of over-insurance, and to the well-known advantage of a total loss.

S.

ENGLISH, SCOTCH, AND FRENCH STEAMERS.

Sir,—While "Bow-bells" and "Caledonia" are standing up for the superiority of Cockneyshire and the Land of Cakes respectively, in the matter of steam-ship-building, a third competitor threatens to step in and carry off the palm from both, and from Great Britain altogether. It is the French who now claim the first place in the art, as appears from the published manifestoes of the "St. Valery-sur-Somme Steam Packet Company," who have invited the whole body of English ship-builders and engineers to view their first vessel, the "Castor," and, seeing her 'perfection,' to give up the contest in despair. What have these gentlemen done? Are the claims of the Frenchmen admitted, or have the London builders still courage enough left to uphold their pretensions against both Scot and Frank?

The proprietors of the "Castor" unhesitatingly claim for her the praise of being the fastest steamer afloat, and have challenged "any English sea-going boat" to run a match with her. By the terms of the challenge, the "Ruby" and the other Gravesend clippers are excluded,—but what says that *sea-going* paragon, the iron "Rainbow," to the invitation? Surely she will not suffer a foreign competitor to come into her own port and dare her to the trial without at least attempting to prove the superiority her builders have ever asserted for her, in point of speed, over all her rivals. What also have our Scottish friends to say to it? The Dundee large

steamers have hitherto kept up a tolerable reputation for celerity; are they ready to part with it to this interloper? or is it just possible that the manifesto in question is simply a capital specimen of Gallic boasting? If it be not,—if all its statements may be fully relied on, the English steamers may well eschew a match with her, since they could never hope to surpass a feat which she is said to have already performed; viz. making her passage *against wind and tide* from Havre to London, at the rate of 12½ *knots an hour!*" No English steamer, or Scotch either, (we might almost add, no American) has ever approached so miraculous a performance as this: the report of which, however, "merits confirmation" before admitted as true.

After all, the greater part of the credit is due to our own countrymen; the engines and machinery being the production of "Mr. Barnes, of London," who (with his former partner, Mr. Miller) also supplied the engines for the French Mediterranean mail packets' which, it has been asserted, are the fastest steamers in the world. It is the English *ship-builders*, therefore, who are most deeply interested in running the intruder off her legs; the London ones more especially, on account of the vessel in question starting from their port, and her owners inviting inspection of her *at a wharf in the Thames*, in proof of her being "the best specimen of the improvements, if not of the *superiority*, now claimed by the French ship-builder," as their manifest has it. Let us hope, therefore, that the men of "Bow-bells" will look to it, and make Monsieur Crappo repent the challenge he has had the hardihood to insert in their own newspapers.

I am, Sir,
Your very obedient servant,
OBSERVATOR.

May 21st, 1839.

COFFEE MAKING MACHINES.—PALMER'S AND BEART'S.

Sir,—I am "one of the million" who love coffee. I am not a *tea*-totaller but *a coffee-totaller*. The Arabian berry is *my sole, and therefore my* total enjoyment. *I have drank its infusion* in all its varieties, from the penny-a-cup of the Whitechapel coffee shop, to that of the Constantinople Divan. Coffee pots and machines of all kinds I have tried, percolators, fountains, filterers, steam fountains, and a host of others. Some years having elapsed since any thing novel in this way had come out, I began to think that the subject was exhausted, when I read in your report of the Royal Institution Conversazione the statement that Palmer's pneumatic filter had been used for making coffee with success. Allow me thus publicly to return my thanks to the unknown "scientific friend" who suggested to Mr. Palmer the idea; properly performed, the result of the operation is a delicious beverage—with Mr. Testall the chemist, I declare, "I have tseted it, I have tried it, and I must know!"

Since the "scientific friend's" or Palmer's, coffee pot has become famous, another has taken the field, under the awful patronage of a patent. Seduced by the low price advertised, I bought one of "Beart's patent pneumatic coffee pots" without the previous precaution of examining its construction and operation, and I am sorry to report that I "paid dear for my whistle." Abernethy is said to have recommended to a fat Alderman as a cure for indigestion and the gout, to "live on sixpence a day and earn it." I should recommend to Poor Law Guardians the adoption of Beart's coffee pot in workhouses—and that the order of the day should be—no breakfast till you have made the coffee. Beart's *patent* (I find by reference to your list it is actually so) coffee pot consists of a cylindrical vessel, about 9 inches high and 3½ in diameter: in this cylinder is fitted a metal piston, packed air tight round the edges, perforated with holes, and covered with a filtering cloth. This piston has a piston-rod and handle about the length of the cylinder. To make the coffee, the piston being thrust to the bottom of the cylinder, the powder is placed above it, water poured on, and the piston is then, say the printed directions, to be "*gently* raised." Otherwise than *gently*, I defy any man to raise it; and this *gentle* raising is only to be effected by tugging away very *fiercely*;—the only way indeed in which it can be done, is to place the pot on the ground and putting the feet on the bottom ledge of the pot to pull

way for from five to ten minutes with the whole power of the body:—then to breakfast, with what appetite you may.

If I had had the Yankee foresight to have *calculated* a moment before I purchased the article I would not have been thus humbugged.

The affair is the size of the air-pump of a two or three-horse power, low pressure steam engine. I confess I have no wish to perform steam engine duty to get my cup of coffee. Hoping you will publish this letter in time to save some brother lovers of the "drink which cheers but not inebriates," from being hoaxed or humbugged,

I remain, Sir,
Yours,
MOCHA.

Hampstead, May 15th, 1839.

PERPETUAL MOTION PREMIUM.

Sir,—Having, after many trials, at length succeeded in discovering the perpetual motion, I am naturally desirous of profitting by the discovery. I shall therefore be highly obliged to you, or any of your readers, who will be kind enough to point out the steps I ought to take to obtain the reward offered by government. Many of my friends have indeed assured me that there is no such thing, just as gravely as others have laid it down that the perpetual motion itself is an impossibility; but as I perceive the "proclamation from our government," and "the reward offered for the perpetual motion," are both alluded to by Mr. Edward Sang in a lecture read before the Scottish Society of Arts (*Mechanics' Magazine*, vol. xxxi, p. 57); and as that gentleman evidently seeks the very best authority for all his assertions, my hopes of becoming rich at one stroke are fully revived.

I only add, that if that gentleman or any of your correspondents will only take the trouble to point out *where and when* the reward in question was offered, I will gladly pay the party one thousand pounds out of the money,—when I get it. Till then I remain,

Mr. Editor,
Yours and theirs,
VON HUMBUG.

May 20th, 1839.

HEATON'S PLAN FOR PREVENTING VIBRATIONS OF LOCOMOTIVE ENGINES —NOT NEW.

Sir,—In your last month's Magazine I observe a letter from Mr. G. Heaton of Birmingham, giving the practical details of a successful application of an invention to neutralize the defect of the swaying of the locomotive engine (so familiar to railway engineers) by appending a weight to the wheels sufficient to balance the cranks, &c., and which had since been adopted by the London and Birmingham Company.

Without wishing to detract from Mr. Heaton's ingenuity, I fear he will find that he has been forestalled in the invention, inasmuch as all engines manufactured since December last, by the eminent firm of Messrs. Sharp, Roberts, & Co. of Manchester, are furnished with this useful appendage, and for which they make no claim of originality, having previously seen it applied to a locomotive upon the London and Southampton Railway; the invention, or application, they attribute to Mr. Dawson, attached to that line.

Mr. Roberts quite confirms Mr. Heaton's conclusions as regards the material abatement of the side motion obtained by the introduction of crank balances, which he describes as having been often suggested, but which he candidly informed me he had generally a poor opinion of. His adaptation is an improvement upon Mr. Dawson's, which was the having the space between two spokes of the wheel filled up in the form of a pannel as a counterpoise; the same object Mr. Roberts effects by applying a little additional substance to the periphery of the wheel only, and that being the most distant point from the centre, takes less weight of metal to render the balance effective, at the same time does not so much destroy the uniformity of the entire wheel.

Your very obedient servant,
RICHARD EVANS.

Manchester, May 15th.

BADDELEY'S PORTABLE DAM.—THE SOCIETY OF ARTS REWARDS.

It is with much pleasure that we republish from the last part of the 'Trans-

actions of the Society of Arts, the description of our respected and valuable correspondent, Mr. W. Baddeley's portable dam, for his invention of which he received from that body a silver medal. The insignificance of the reward is no test of the merits of the invention; it is more the misfortune, perhaps, than the fault of the Society that more respectable premiums are not offered and awarded for useful inventions: the silver medal, we believe, is the highest honorary reward. Every one who may have attended any of the Society's meetings, will, we think, agree with us that a little life is required to be imparted to its transactions. The time of the Committee is so generally taken up, and dwindled away, with projects and plans so evidently absurd, foolish, and puerile, that a really good thing stands little chance of having a fair consideration, especially if it stand second or third on the list. The constant attendants at the Committee are present more from habit than any thing else, and generally carry every thing their own way; and many of the eminent engineers and men of science, whose names appear on their list of members, have perhaps never, or at most, not above once or twice, been within the doors of the Institution.

In turning over the pages of the Part of the *Transactions* now before us, we find prefixed an "Advertisement to the public," which commences thus:—"The chief object of this Society is to promote the Arts, Manufactures, and Commerce of this kingdom, by giving *honorary* or *pecuniary rewards*, as may be adapted to the case, for the communication to the Society, and through the Society to the public, of all such useful Inventions, Discoveries, and Improvements as tend to that purpose." There is furthermore appended to the *Transactions*, a statement of accounts for the year 1837-8, by which it appears that the sum of £1933 5*s*. 1*d*. had been received by subscriptions and otherwise. How much does our reader think was out of this sum expended in the "chief object" of the Society? No *less* than, for "medals and premiums, £156 8*s*. 5*d*.!" We shall only remark that it appears to us, that a proper pro, *portion of the funds of the* Society are *not expended in endeavouring* to accomplish its "*chief object.*"

Immediately following the words above quoted from the advertisement, occur also these:—"in pursuance of this plan, the Society have already expended upwards *of a hundred thousand pounds*, derived from voluntary subscriptions and legacies," now we think it would be interesting to the members to know whether this sum is the total amount of the receipts of the Institution during the eighty years it has existed, or whether it is that of the item in the accounts of "medals and premiums?" We fear it is the former, although, from the context of the paragraph, it would be understood as the latter. It will certainly be granted that the "chief object" of a Society should demand the chief portion of its funds to be expended in its accomplishment, and allowing fifty per cent for expenses, the remaining moiety of last year's receipts would have been amply sufficient to reward respectably a few inventions of real practical utility, in a degree, which would equally benefit the successful competitor and reflect honour on the Society.

The publication of an invention by the Society itself, is of an extremely limited nature: generally about a twelvemonth after the award of the premium, a description is published in the *Transactions*, which are distributed amongst the members, and a few sold: this is the amount of publicity given by the Society; were it not for the contemporary notices of newspapers and other periodical publications, the invention would probably be forgotten even by its inventor before it appeared in their volume. Then, when it has been ushered into the world, with all the parade of fine paper and wide margin, it would lie still-born were it not that, if of merit, it is transferred to the pages of some such popular and widely-read Magazine as our own. The Society *may* have done an amazing amount of good to the "arts, manufactures, and commerce of the kingdom," as one of its advocates asserted in our Magazine some time ago, but really it does so completely hide its light under a bushel, that the world cannot find it out.

Mr. Baddeley's invention, which the Society of Arts thought worthy of its highest honorary reward, viz. that of a medal, worth intrinsically about five or six shillings, accompanied perhaps with

a laudatory address on presentation by his Royal Highness the Duke of Sussex, viz, as first constructed, published in our 215th Number, nearly twelve years ago. It is considerably improved as presented to the Society, and we *do really think* it was worthy the premium awarded:—if Mr. Baddeley is satisfied, so are *not* we. The model "placed in the Society's Repository" was intrinsically worth the medal given to the inventor, and so far there is a *quid pro quo*—but where is the encouragement afforded by the Society?

The following are the communications upon the subject of Mr. Baddeley's "portable tank:"—

"Wellington-street, Blackfriars' Road, March 6, 1838.

"Sir,—I will thank you to submit to the consideration of the Society of Arts the accompanying model of a portable dam or tank, for procuring expeditiously a supply of water for fire-engines.

"It is now upwards of sixteen years since I was first struck with the inconvenient mode followed by the London firemen for supplying their engines with water. This was at that time accomplished by tearing up the road-paving to form a dam, in which, the water issuing from a plug, fire-cock, &c. was collected in a body; the end of the suction-pipe being laid therein, the water was thence drawn up on working the engine. Getting up the stones was always a work of great difficulty, and since the introduction of the improved method of paving with sovereigns, has become almost, if not quite, impoesible. To avoid all the evils arising out of the difficulties just stated, and economise as much as possible the men's labour and time (both invaluable at fires), I invented a piece of apparatus, which I called a portable dam. The first were made very strong, entirely of wood; but by the employment of canvass sides (as in the model herewith sent, a more portable and convenient form is obtained.

"The apparatus consists of a wooden frame, about three feet long and two feet wide, and a bottom-board six inches smaller each way, with a circular aperture in the middle, furnished with a female screw. A piece of stout canvass, from fifteen to eighteen inches deep, connects the frame to the base-board. Two forked pieces of metal, hinged to either end of the frame, take into racks in the base-board and support the frame. A brass tube, of a size to fit all the fire-plugs, screws into the *circular opening. On reaching a fire, and a plug being opened, the tube is* put into it, and the dam is instantly filled with water; the suction-pipe being laid therein, the engine may commence working. In this way a fire-engine can now be got to work in one minute and a half; under the usual method of proceeding, from twenty to thirty minutes frequently elapsed before this could be accomplished.

"When an engine is not working from a plug, but from water brought in buckets, &c., instead of the tube before mentioned, a brass cap is screwed on to the bottom, and the water poured into the cistern thus formed, which is much better for the purpose than the engine cistern, as it can be surrounded, is clear of the handles, the parties working the engine are not splashed, &c. In the employment of this cistern in streets, the water is delivered clean to the engine; all grit, stones, and substances that might injure the works, being wholly excluded.

"These 'portable dams' have, for the last four years, been constantly employed by the engineers of the London Fire Establishment, with incalculable advantage. Their value at the late fire at Davies' Wharf, Horsleydown, was strikingly manifest; while the whole of the roadway was covered with floating oil and turpentine, the engines were supplied with pure water by the portable cisterns. But for their employment, the engines would have been throwing back into the fire, water largely mixed with oil and turpentine, thereby increasing the fury of the flames.

"This simple piece of apparatus supersedes a cistern in the engine, which may therefore be reduced in its dimensions, or stored with hose and other matters useful at fires. The suction-cock, the most precarious part of a fire-engine, is also rendered wholly unnecessary, which reduces the cost, and ensures the efficient performance of the engine.

Any further explanation that the Society may deem acceptable, I shall be most happy to give; and shall only add, that I have most perseveringly laboured for sixteen years, at great expense and considerable personal exertion, to procure the general adoption of this very useful and convenient apparatus, without ever seeking the slightest personal advantage. I therefore look, with some degree of confidence, for such an encouragement as your Society shall consider adequate to the merits of my invention.

"I am, Sir, &c. &c.

"WILLIAM BADDELEY.

"A. Aikin, Esq. Secretary, &c. &c.

"P.S. I enclose testimonials from Mr. Braidwood, the superintendent of the London Fire-Engine Establishment, and from the two principal engine makers in the me-

tropolis, whose experience of the advantages of my invention will, I am sure, be highly satisfactory to the Society.

"W. B.

"*Reference to the Figures.*—The cistern is made of a wooden frame, *a a*, fig. 1, and a board, *b b*, which goes loosely into it so as to pack into the same thickness, which is about two or three inches. These are united by cloth, which is nailed to the inside of the frame, and to the outside of the board; so that when the board is allowed to fall out, and the rods *c c* to drop after it, and catch in the racks *d d*, fig. 2 (which is a top view),

Fig. 4.

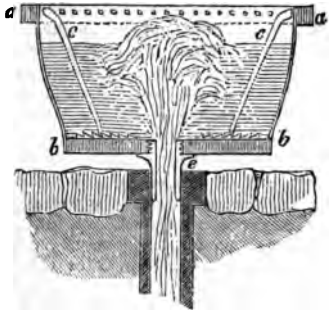


Fig. 1.

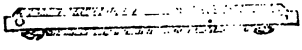


Fig. 5.

Fig. 2.

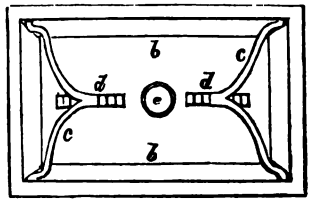
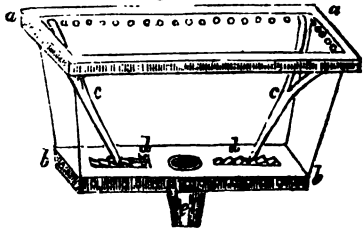


Fig. 3.



it is rendered stiff and ready to hold water. Fig. 3 is a perspective view, as ready for use; and fig. 4 is a section of the cistern in use, or in the act of being filled from a plug. The rods, *c c*, enter into holes in the frame, which serve as joints; a short pipe *e* is screwed into the central hole of the bottom piece, to fit the cistern to a plug. as in fig. 4; but if it is to be placed under a pump, or if water is to be poured in from a bucket, &c., the flat cap *f*, fig. 5, is screwed in instead of the pipe *e*.

"London, 68, Watling-street,
Feb. 27, 1838.

"Dear Sir,—In answer to your letter of the 20th instant, I beg leave to state that the 'portable cisterns' have been of very great service to the London Fire-Engine Establishment, and are becoming daily more useful, as the new plan of paving extends.

"At the fire at Davies' Wharf, some of the plugs were surrounded with oil, and it would have been impossible to have obtained water free from oil without using the portable cisterns.

"I am, Sir, &c. &c.

"JAMES BRAIDWOOD,
"Superintendent of the London Fire-Engine Establishment.

"*Mr. W. Baddeley.*

"245, Blackfriars' Road,
Feb. 22, 1838.

"Dear Sir,—In reply to your letter of 20th instant, requesting my opinion of your 'portable dam,' I beg to state that I consider it a most useful invention, which I have often availed myself of, and that they are almost indispensable with the London engines. Now, the paving of the streets is so firmly cemented, as to render it a tedious and difficult task to form dams as heretofore. Your dam, on the instant drawing of the fire-plug, forms a reservoir of water for the fire-engine, excluding grit, straws, or any other matter that might impede its working.

"I am, Sir, &c. &c.

"W. J. TILLEY.

"Mr. W. Baddeley.

"Long Acre, Feb. 23, 1838.

"Sir,—I have made some of your portable dams, or water tanks, both for London and the Country, which are carried inside of the engines; and I consider, from the very great portability and simplicity of construction, that they are decidedly superior to the old plan, or any other plan that has come within my experience—not only for their portability, but directly a plug is drawn from the street you have a supply of water for the engine, which is very essential, and of the

utmost importance at the commencement of a fire. In the country it is also a great acquisition; for instead of carrying a great tub on the engines, this dam is substituted, which is kept supplied by a quantity of buckets. It is much better to use a tank of this description with a suction-pipe in it, than to fill the engine; for, in the latter case, a great quantity of water is wasted in pouring it in the cistern.

"I am, Sir, &c. &c.

"M. MERRYWEATHER.

"Mr. W. Baddeley."

MERIMEE'S ART OF PAINTING IN OIL AND FRESCO.*

M. Merimee's work was originally published in France, under the sanction of the Academy of Fine Arts, after being examined by a commission from the Royal Institute, who reported that great advantages must result to the art of painting from its publication: it is now translated at the suggestion of several distinguished members of the English Academy (to the President and Members of which it is dedicated), and therefore comes before the public with high recommendations. It will be supposed that a work on art must possess no small degree of intrinsic merit with which these institutions would allow their names to be connected, and that such is really the case, will be judged from the following extracts from the Report of the Examiners:—

"The precepts which the author has collected, extended, and developed, with the judicious advice he has offered, are not so much intended to teach this art, as to lay before the artist the proper materials for painting, and how to make pictures durable.

"The great object of the author appears to be, that of bringing to light the primitive processes of painting; for this purpose he has consulted the earlier works on this art, and has examined with the greatest care many of those pictures which have most successfully resisted the effects of time and exposure; and he is decidedly of opinion, that these works owe their preservation to particular modes of combining, in a liquid state, *resinous substances;* by the use of which the colours were defended from the action of causes that have injured or destroyed pictures of much more modern dates.

"A considerable part of the work relates to the preparation of colours, and belongs properly to what may be termed the chemistry of painting; and we can bear ample testimony to the extensive and accurate knowledge of M. Merimee, who it is evident has selected with judgment from amongst a heap of preparations and receipts, those which he found approach nearest to the simplicity of nature; for it is a remarkable fact, that the most permanent class of colours are those which have been the slowest of creation in nature's laboratory."

These extracts from the Report show the scope of the original. In most of the books already in existence on this subject, the various hints of a practical nature are scattered among a mass of theoretical writing, often exceedingly fanciful, and more calculated to confuse the mind with its capricious refinements, than to place simple and true principles before the studious enquirer; and through all this the perplexed tyro must grope his way—more likely to miss than to find what would guide him in his efforts. In this book, which is essentially practical, we have all this knowledge selected and arranged in a more lucid manner by far, than has ever been even approximated to; and although we think that there is a want of that clearness which would be of the greatest utility to the student, but is a style of writing seldom attained by those who, fully acquainted with a subject, try to impart it to others to whom it is altogether new—still the work must afford to the artist great advantages not hitherto within his reach.

An instance of the fault justl alluded to, is found in the following extract:—

"That the brightness of colours is greatly augmented by varnish, is allowed by all painters, but *it is found that this advantage is only gained at the expense of the solidity of the colouring, which fades in time;* for to its injudicious use is attributed the cracks that appear often in pictures, and which sooner or later occasions their destruction."

The author, in the part put in italics, seems to contradict his own opinion; and this sentence is calculated to confuse—it requires an attentive notice of other passages to ascertain the intended meaning. Subsequently we find:—

* *Art of Painting in Oil and Fresco, &c., translated from the French of M. de Merimee;* by W. *B. Sandfield Taylor, London, Whittaker & Co. pp. 372.*

"Several manufacturers of varnish, wishing to realize a great profit, do not put in a proportion of mastic sufficient to render it brilliant; they often substitute the strong oil of turpentine, which is much cheaper, and produces for the instant a similar effect, but varnish prepared in this way *soon loses its transparency*, it dries only on the upper part, a portion of it penetrating under the surface of the colours softens them, and the picture is soon covered with cracks; these accidents happen whenever a couch of colour not dry underneath, is covered by one of a thin consistency, completely dry; the soft portion dilates itself when the temperature is raised to a certain height, and the upper surface, not having the power to resist or to follow the expansion of that underneath, becomes soon cracked on the surface, the moment it is exposed to any ordinary heat.

"That the proper use of varnish is not the cause of the picture becoming cracked, is proved by the vast number of varnished paintings that remain without any alteration, and also our coaches, and the numerous objects in japanned work, which are exposed to every sort of temperature."

It appears accordingly, from the author's investigation, very evident that the cause of cracks and discolouration in paintings, arises from bad varnish, or an improper manner of its application; it becomes, therefore, highly necessary that the artist should be able to test this vehicle, and ascertain its goodness before he can be sure of the durability of his work. The cupidity of those manufacturers to whose fraud much of the ill effects which have resulted are to be attributed, cannot be too severely reprobated, as tending to retard the advancement and injure the stability of the highly delightful and useful art of painting. We are aware that eminent artists of the present day are opposed to the practice of using varnish in painting, founding their opinion on the injurious consequences previously described, but Mr. Merimee has clearly shown that this is to be traced to the bad quality of the material, and that from its proper employment we should attain the much desired durability of ancient paintings.

Much important information may be found on the subject of the grounds—scarcely of inferior consequence to the vehicle, in effecting permanency. The following mode of preparing a cement is *interesting, and might be useful* for many *purposes*:—

"Theophilus (one of the oldest writers on the subject) informs us, that the planks or boards of which the panels were composed, were prepared by a tool used by vat-makers, probably the rabet plane; these planks were then cemented at their edges, by a glue made from cheese; the manner of making which he describes, and he assures us that thus united, neither moisture nor dryness could separate the joints. This remarkable fact has been verified by experience, which clearly shows the superiority of this method of glueing. It is done in the following manner:—

"Take some fresh cheese made with rich creamy milk, triturate and wash it in warm water, until all the soluble part is carried off by the water, this may be operated in a sieve or linen cloth, through which the cheese is afterwards pressed to get rid of the water, when quite drained it crumbles like stale bread, it is then dried upon unsized paper, and in that state will keep fresh a very long time.

"This material, which is *caseum* mixed with a small proportion of butter, is not soluble in water, except by the addition of quick lime; but by triturating this mixture, it becomes transformed into a very viscous sort of cream, which can be diluted with water to the consistency required for the work. It dries quickly, and when quite dry it cannot again be dissolved; therefore, no more should be prepared than can be immediately used.

"To prove the fact, some prepared boards have been exposed to the alternations of rain and sunshine for some weeks; one portion was jointed with the ordinary glue, and the other with the glue of cheese. The first-mentioned gave way in the joints after the rain and sun had acted upon them; but the latter remained quite firm and undisturbed."

The latter part of Mr. Taylor's book is occupied by a sketch of the progress of the Fine Arts in England. We agree with Mr. Taylor in the opinion that British artists are fully equal to any in the power of producing works of the highest class—but that the circumstances of the age have not afforded opportunities or encouragement for the exercise of these talents, to such an extent, for instance, as when painting was employed as an auxiliary to foster religious feeling in the Roman Catholic countries; though, by the way, we are sure tenfold encouragement is here given to the really useful exercise of this art in ministering to the every-day happiness of domestic life. Pleading the British artists' cause, the author says:—

"The last seventy years* may rightly be considered the age of the British school, and for that limited space of time there is no other school can show greater, or perhaps so great an improvement. In Italy, with its fine climate, and enormous public encouragement, as well as private patronage, it required full two centuries and a half † to bring these arts up to their meridian splendour.

On this head we would just hint, that British artists have had the advantage of appropriating to themselves and forming their minds upon the beautiful works of antiquity, which have been handed down to them and which are still unsurpassed; and a parallelcan not be fair in which this point is left out of view.

We regret that a work of so much utility should have any signs of want of care in the getting up; a prominent one is in the front—where the representation of the chromatic scale is erroneously coloured; it ought to graduate from the centre to the circumference. Notwithstanding these imperfections, the work is one of the most useful of its kind; and the professor as well as the tyro will gain from an attentive study of it, great benefit.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal* for March.

IMPROVEMENT IN THE MANUFACTURE OF GUNPOWDER, *Richard J. L. Witty, Lowell, Massachusetts.*—My discovery (says the Patentee) consists in using a material capable of yielding a large quantity of carburetted hydrogen, or inflammable gas, namely, bituminous coal. The coal is to be highly comminuted with certain proportions of sulphur and nitrate of potash. These three substances are taken in a powdered state, and then mixed together; but, since these ingredients vary in quality, or otherwise, they will require their definite proportions to be adapted to each other. Here follows a formula which I have used, and found to answer well, viz.:—

Bituminous coal,	26 lbs. or parts.
Nitrate of potash,	156
Sulphur, ..	33½

And in order to make the gunpowder, the above ingredients are to be intimately mixed together, as must be the case in preparing gunpowder from any materials, and then the combination may undergo the same process as is at present practised with common gunpowder, viz., in the pressing, graining, glazing, and drying.

What I claim as my discovery is the making use of bituminous coal, instead of charcoal, to form gunpowder with the other ingredients at present used, viz., sulphur and nitre, and for the use of these two last named ingredients I do not claim any exclusive right.

Remarks by the Editor.—We very much doubt the improvement of gunpowder by the substitution of bituminous coal for charcoal, in its composition; the production of carburetted hydrogen, spoken of by the patentee, will rather be a production of carbonic acid and watery vapour, these being the ultimate products of the combustion of the bitumen. We are very apprehensive, however, that the decomposition of the bitumen, and the combination of its constituents with oxygen, will not be equally rapid with the combination of charcoal and oxygen; this, it is true, must be decided by experiment, and should the fact be such as we apprehend, the explosion will take place without the perfect decomposition of the bitumen, the powder will be injured in quality and it will render the piece more foul than powder of the ordinary composition, which, indeed, when well made, does not require to be improved, as, if more powerful, the arms in which it must be used must necessarily be increased in weight.

MODE OF PRINTING CERTAIN COLOURS UPON CALICO OR OTHER FABRICS, *Bennet Woodcroft, of Great Britain.*—After describing the mode of procedure adopted by the patentee, he says:—

"Now whereas I do not claim, as my invention, either the printing machine, or the particular construction or material of the dress to be used by the said operatives. But whereas I do claim as my invention the enclosing calico or other fabric intended to be printed, along with the printing apparatus, whatever it may be, and the material to be printed upon them, in a chamber, case, or compartment, filled with an artificial atmosphere, deprived of, or devoid of, free oxygen, such as atmospheric air, deprived of its oxygen, as hereinbefore described, or any other suitable artificial atmosphere, and there printing the said calico or other fabrics, with a solution of deoxydized indigo when required to produce a blue colour, or with a solution of deoxydized indigo and other suitable materials as are usually used in combination with indigo, when required to produce other colours, and subsequently exposing the said calico and other fabrics, so printed as aforesaid, to the action of the atmospheric air, in order to imbibe the neces-

* *Since the foundation of the Royal Academy.*
† *Cimaline commenced about 1260, Da Vinci and Raffaell both died 1520.*

sary quantity of oxygen therefrom to produce and fix the colours required."

An air-tight room is to be made of sheet iron, and this is to be furnished with an atmosphere of nitrogen; this is accomplished by means of a large air pump, which pumps the water out of the room, passes it through tubes into purifiers filled with a solution of sulphuret of lime, which deprives it of its oxygen, when it passes again into the room through tubes leading from the purifiers; and this operation is continued until no sensible quantity of oxygen remains in it. The entrance into the room is through a tank filled with water, which forms a water lute, by a partition dipping a little way below the surface of the fluid. This serves also to allow fresh air to be forced in by atmospheric pressure, as the volume is decreased by the absorption of the oxygen. The workmen have dresses of India rubber cloth, similar to diving dresses, and air is supplied to them by bellows and tubes, as in diving apparatus.

Machine for paring, coring, and dividing Apples, *Robert W. Mitchell, Ohio.*—This, we believe is the fourth patent obtained for the same purpose; in that before us the apple is to be placed on a fork at the end of a shaft, or mandrel, turned by a crank, whilst the paring knife, furnished with a guard, is held in the right hand, and passed from end to end over the apple; this is then pushed towards the shaft which is furnished with knives that cut it into quarters—a centre tubular knife removing the core.

Apparatus for obtaining a high degree of velocity on Railroads, *Jacob Nollner, Washington.* This is one of those strange conceits which sometimes insinuate themselves into the minds of intelligent men, although it would be difficult for a looker on to find the avenue by which it could obtain an entrance; indeed it might well be supposed that every avenue leading into such minds would be so well guarded by the watchful sentinel, good common sense, as effectually to repel such interlopers. The plan proposed is neither practical or practicable, nor did the inventor himself really think it so, but determined to place it upon record, under an impression that it might suggest or lead to something useful, "so mote it be."

Let a railroad be made, perfectly level and straight, and solid as the everlasting hills; let a car twenty miles long be placed on this, and be drawn by any adequate power; let another car, say of ten miles in length, be *placed on this first car at its rear* end, and let *this also have an adequate independent motive power applied to it.* Now let the two cars set off together at the rate of twenty miles an hour; the upper car will, in this case, travel over the ground at the rate of forty miles an hour, twenty being due to the motion of the lower car, and twenty to its own motion. In the model at the patent office, there are four or five such cars, or moveable railroads, stratum superstructum. The following is the claim:—

"What I claim is the placing of two or more moveable railways, platforms, or articles capable of progressive motion, one above the other, so that each may be drawn along by an independent power applied to it, and, like itself, sustained upon the railroad, platform, mounted railway, or other article upon which it is to move; and this I claim, whatever form or arrangement the same may be made to assume, whilst the principle of action is the same with that herein exemplified."

Fire Engine Pump, *Joseph Newman, Baltimore.* This is a device for converting the common street pump into a fire engine, by adding a forcing apparatus at its top, furnished with an air vessel, and other appendages. When thus used, the ordinary spout is to be stopped, and a hose or branch pipe applied to the forcing apparatus. The claim is to "the combination of the common pump prepared as described, with the cylinder, piston, valves, or air chamber of the ordinary hydraulic or fire engine, which combination produces a twofold instrument, viz. a self supplying fire engine, and a culinary, or common pump."

There is no novelty in the foregoing idea. The late Mr. Dearborn, of Boston, proposed a similar thing more than forty years ago, of which engravings are to be found in our own, and in foreign journals. The thing, however, cannot possibly answer a good purpose when appended to the ordinary pump, as the power requisite to raise the water from a well, and to force it to the required height, cannot be applied to such a pump; and, if it could, but few such pumps would bear it. Whatever of ingenuity there may be in such a combination, will not be accompanied by a corresponding degree of utility.

Improvement in the Steam Engine, *Seth Graham, Massachusetts.*—This is a bad contrivance, with little novelty, and no utility. A revolving cylinder having a groove around it, such as would be produced by making a section of the cylinder at an angle of forty-five degrees with its axis, and then separating the two parts to a proper distance, to form a groove of suitable width. This groove is to admit a pin on the cross-head, furnished with a friction roller, and is thus to become a substitute for the crank. A shaft is to pass through the cylinder, is to

run on proper bearings, and to have a fly-wheel at one end; the steam cylinder, and appendages generally, resemble those of ordinary engines. In some places, where substitutes are admitted in the militia, a poor creature is allowed to take the place of an able bodied man; the substitute in this engine appears to us to belong to the same system.

IMPROVEMENT IN THE ART OF DYEING, *Patrick Magennis, Paterson, New Jersey.*—"The nature of my improvement consists in performing the operation of dyeing by one process, which is effected in the following manner:—

"The cloth, or other material to be dyed, is taken, without any previous preparation, and passed through the vessel, or box, containing the colouring matter, and from thence, immediately passed between heavy rollers, or squeezers, whereby the colouring matter is effectually forced into the cloth, or other material.

"It is then dried; and being so dried it is passed through the vessel, or bag, containing the proper mordant, and from thence again immediately passed between heavy rollers, or squeezers, whereby the mordant is also effectually forced into the cloth, or other material, which is then dried, and the process of dyeing is finished.

"The colouring matter and mordants to be used in this process are the same as those commonly used by dyers, except that in this process they are more highly concentrated, and the degree of concentration depends upon the shade of the colour required. The rollers, or squeezers, and colour boxes commonly used by dyers, may be used for this process. But what I claim as my discovery and invention, and desire to secure by letters patent, is the manner of applying the colouring matter and mordants in a concentrated state, to the dry cloth, or other material to be dyed, by passing the same between rollers."

IMPROVEMENT IN RAILROAD CARS, CARRIAGES, OR TRUCKS, &c., *Joseph Harrison, Philadelphia.*—The main object of this improvement is to obtain a more equal bearing upon the rails of the wheels of railroad carriages, than has been hitherto attained. The opposite ends of a spring are to bear upon two sliding boxes, in two plummer blocks, which boxes receive the ends of the two axles of the carriage wheels. The spring is of the usual construction, but mounted so as to vibrate on its centre, allowing the two wheels on each side to adapt themselves to the inequalities of the road, without altering the relationship of the action of the spring. Several variations in the mode of arrangement for carrying out the same principle, are described and represented by the patentee.

"In truck frames which turn on a centre, for the purpose of adapting the wheels to the curvature of a road, the patentee has, in order to render the system of the equalization of the pressure of the wheels upon the rails perfect, so constructed the frames of such trucks as that their sides shall not necessarily continue in the same plane, but be allowed to vibrate vertically to such extent as may be requisite to enable them to adapt themselves, and the wheels which they sustain, to any horizontal inequality in the rails upon which they are to run, as this cannot be effected by the limited action of springs."

In this latter arrangement the wooden sides of the truck frame are connected by transverse and diagonal bars of iron, which work on pins, allowing of the requisite vertical motion in the sides, whilst they are braced perfectly so as to prevent their racking laterally. The claims are as follows:—

"What I claim as my invention in the within described modes of constructing cars, carriages, or trucks, to run upon railroads, is the constructing of the springs and their appendages, so that said springs may vibrate upon their centres, for the purpose, and substantially in the manner, set forth. I also claim the carrying out of the same principle, by means of a vibrating beam, or any analogous contrivance, connected and arranged so as to produce the same effect. I also claim the use of a truck frame which may be employed with cars and locomotive carriages of all kinds, to run upon railroads when trucks are required; said truck frame being constructed in such a way as that two parallel sides thereof may be allowed to play, in the manner and for the purpose set forth, whether the same be put together in the method herein made known, or in any other by which the same end is attained, on the same principle."

ROYAL INSTITUTION.—SMITH'S ANTISEPTIC FLUID.—MR. FARADAY'S LECTURE ON FLAME.

May 10.—*The Conversazione.*—We omitted to mention in our last report, that there were exhibited on the former meeting two very fine specimens of birds—a peacock and a vulture—preserved by means of "Smith's antiseptic fluid." If that which is stated in the prospectus concerning its many important applications should be fully borne out by further experience, the discovery will certainly be considered as one of considerable utility. On the present occasion we shall only notice a very excellent improve-

ment on the thermometer, by Mr. Newman, consisting of a line of white enamel forming the back of the glass tube, by which means the surface of the mercury is very distinctly seen.

The Lecture.—Mr. Faraday's subject merely comprised "Some general remarks on flame." It was, however, rendered very interesting by the experiments that were introduced, and by the exhibition and explanation of the apparatus that Sir Humphrey Davy adopted, when engaged in those investigations which led to the invention of the safety lamp. The principal object of the lecture was to show, that notwithstanding the exceedingly high temperature of flame—greater than any furnace can produce—the results which from this consideration alone one might be led to anticipate, are singularly modified, and in some cases the action of the flame is completely neutralised, by reason of the little density it possesses, or of the small quantity of matter which is in combustion, the combustible being a gas and not a solid; in consequence of which, its power of heating and inflaming bodies is circumscribed within limits, determinable by the mass which is submitted to its influence and the time during which it is so submitted. The high temperature of flame being, for the reason above stated, very susceptible of being easily and quickly cooled below the igniting point, it is necessary, in order to obtain the effect which it is naturally capable of producing, that the flame should, for some short time at least, be continued—that the substance operated on should be small—and that all cooling influences should as much as possible be avoided; and it is to the non-fulfilment of these conditions that certain singular results and apparent anomalies are to be attributed. Thus even gunpowder, if in a solid state (pardon the unavoidable *bull*), and if passed quickly through flame, will not take fire; thus, even when inflamed, it does not explode, but burns comparatively slowly, as in the case of the gunner's fuse. Hence the utility for explosive purposes, of granulating the substance, in order that the flame may not be delayed in enkindling a mass, but may leap with the utmost rapidity from grain to grain. Thus also, even in this private state of division, a certain though inappreciable portion of time is requisite for its inflammation; as may be seen in the experiment of making the flame from a percussion cap pass through gunpowder without firing it, if it be so contrived that the powder shall not materially obstruct and consequently retard the progress of the flame. Thus again may be explained that *remarkable and most useful* result obtained *by Sir H. Davy, in which* it is seen, that *flame, in passing through tubes,* is so cooled down, that it is incapable of inflaming coal-gas; and that the smaller the tubes, by reason of the greater mass of cooling material in proportion to the heating matter, the shorter they may be made, until at last they become mere apertures, and consequently a sufficient screen may consist simply of a tissue of wire gauze. Thus also, as another illustration of the same thing, a piece of such gauze being brought down over the jet of a gas-light, the flame is unable to penetrate it; but it is to be observed, that if the jet is in any force, this mechanical aid will enable the flame to pass through it, or, which is the same thing, this effect will be produced, if the gauze is brought quickly down upon the flame. Sir Humphrey Davy was aware of this, but he depended, of course, on all ordinary care being observed in the using of the safety lamp. His apparatus for performing the preliminary experiments was very simple; it consisted of a small vessel charged with an explosive mixture of atmospheric air and coal-gas, and closed at the end with a cork, having several glass tubes of different calibres fitted into it, through which the flame was to pass and enkindle a gas jet, when the contents were exploded by the electric spark. By presenting each tube in succession to the jet, it was seen by the explosion inflaming, or failing to inflame, the gas, what tubes would or would not allow the flame to pass. The Lecturer concluded with some remarks and experiments on quick and slow matches, and on the miner's flexible fuse; also on the mode of manufacturing the latter by machinery, and in such a manner, that it is made water-proof; illustrating the same by firing it when bent down into a basin of water, and yet exploding some gunpowder at the other end.

Remarks.—On seeing the facility with which Mr. Faraday, by a slight movement of the wire gauze, caused the gas flame to penetrate its meshes, it was impossible not to be forcibly impressed with the danger which must attend the use of Sir Humphrey Davy's lamp, in the hands, not to say of careless, but even of careful miners. For, safety in the critical circumstance of a sudden inflammation of the fire damp in the body of the lamp, would depend rather on self-possession than on anything else—on such a presence of mind, indeed, as even the philosopher so situated may fail to exert—for what action of a man groping his way with the lamp stretched out before him, would be more natural, on such an occurrence unexpectedly taking place, or even if anticipated, than quickly to catch it away, by which movement the flame would be jetted out forwards, and inevitable destruction would be the result.

We have no disposition whatever to detract from the merit or the brilliancy of Sir H. Davy's discovery as a scientific fact—it was a beautiful philosophical conception, and most scientifically was it educed, but even the authority of his high name will not seduce us into the opinion, that in seeking to embody it in a mechanical form, he evinced the slightest degree of practical skill and judgment. The philosophy of the lamp is *perfect*, but the lamp itself is a poor fragile thing—no better principle of safety is it possible to propose, but a worse application of it could scarcely have been devised. It would almost seem as though Sir Humphrey Davy had allowed himself to be guided in this case, by those views of elegant and refined simplicity, which appropriately enough governs the experimental philosopher in the construction of his apparatus, but which are woefully out of place, in an instrument designed for the rough usage, and liable to all the chances, of working operations. The construction of the lamp, truly, is admirable enough for parading it as a scientific paradox —for showing with what feeble and apparently inadequate means a powerful enemy can occasionally be subdued—and for proving, as if solely to do honour to the protective principle, with how little defence it is possible to repel him; but where is the wisdom of going forth to the encounter with a fearful impending of all the contingences of actual conflict, without being provided with a panoply the most complete that art can devise. Motives connected with a paltry economy in the construction of safety lamps, cannot be imputed to any one, without uttering a calumny.

We are the more surprised that Sir Humphrey Davy was not guided by sounder views on this occasion, inasmuch as he was evidently at one time on the right tract, for there were on the lecture table some glazed lanterns constructed by him, having safety tubes inserted in their bottoms. Not that these lanterns were made with nearly the necessary strength, either in regard to the frames on the glass,* or that when the air had access, and particularly when it escaped, the recession of flame was sufficiently guarded against; but they would not have been liable to those *kinds* of accidents to which the mere wire gauze shade or covering is so peculiarly exposed. This material appears to have been an afterthought, and gladdened probably with the idea, he seems to have thought that he could not make too much of it, and instead of adapting it to his lanterns, and seeking other accessory appliances for security, he in an evil hour, (for the weal of thousands depended on the issue) determined that it should have all the honour by doing all the duty. Thus instead of protecting the light in a strong lantern, he contented himself with merely placing around it a flimsy tissue of wire, which, besides numerous other objections, is, by its gloomy effect, ever tempting the miner to remove it, or to use a better but dangerous light. In the alleged reckless and perverse conduct of the miners, there is found an ever ready scape-goat, to bear the burden and the blame of the numerous disasters, which have arisen during the use of the Davy lamp; but that reckless ness and perversity, a tithe of which is quite enough to be believed, are among the very contingencies, which in a lamp of a good construction should be met and provided for. But notwithstanding the number and extent of these calamities, the generous aspiration which he indulged of becoming the benefactor of his fellow creatures, may yet be realised, if, preserving his principle of safety but adopting a better mechanical construction such men as Mr. Buddle for instance, could but be persuaded to exert their influence in the cause of humanity, and introduce a lamp of this description into mining operations. It is by pursuing such a course, or by urging it upon others, that Sir Humphrey Davy is best honoured, and that the truest respect is paid to his memory.

A serious, or rather an awful responsibility rests somewhere; and for ourselves we feel, that we should have failed in our duty, if on the one hand we had not acknowledged in the fullest and the most unequivocal manner, the great merit and the eventual utility of the scientific principle of the lamp; or if we had flinched on the other, from denouncing in the strongest terms, the delusive security which is held out to the miner, in the mode in which that principle is embodied in practice. We are glad to perceive that public attention is likely to be awakened to the subject, and that Mark Phillips, Esq., has moved in parliament, for a return of the number of deaths caused by coal-pit explosions.

**A bull's eye lens is adopted in lanterns of a good construction.*

EXHIBITION OF THE PRODUCTIONS OF INDUSTRY AND THE ARTS AT PARIS.

The annual exhibition of productions of industry was opened on Wednesday, the 1st instant to the public.

The buildings constructed in the Champs Elysées have a front of 185 metres in length and 82 metres in depth; the façade is composed of a gallery parallel with the grand avenues of the Champs Elysées. Five rooms detach themselves perpendicularly from this

gallery. The rooms and galleries are 10 metres high, and covered with zinc. Notwithstanding the extent of these buildings they are far from being sufficient for the numerous productions which have been admitted. More than one is confined, and much patience and care has been necessary to define agreeably the place assigned to each.

The number of exhibitors is incessantly increasing. In 1834 it amounted to one-third more than in 1827—namely, 2,437. The present number is 3,348, and will probably increase in the course of a few days. In 1827, 20 departments sent nothing to the exhibition; in 1834 this negative number was reduced to 11; and in 1839 to 6. Those six departments are those of the Lower Alps, Cantal, Cher, Gers, Lot, and Lozére: however, we still hope the porcelain manufactories of Cher will send some specimens of their art. The department which reckons the greatest numbers of exhibitors is that of the Seine; out of 3,348 exposers, 2,047 belong to that one, or nearly two-thirds of the whole. That is a large number indeed, even admitting that encouragement should be shown to those manufactures based upon the application of the fine arts. The following departments furnish the greatest number of exhibitors after that of the Seine:—The Seine Inferieure, 96; the Rhone, 73; the Gard, 58; the Nord 56; the Upper Rhine, 55; the Loire, 43, &c.

Amongst the tissues were rich and beautiful specimens of silks, satins, damasks, muslins, lace, blondes, mousselines de laines, cloths, and shawls, from the various departments.

There are numerous excellent specimens of porcelain, particularly those copied from the English, with flowers in relief.

The department of the Allier has exhibited some models which rival those of Paris. The Parisian jewellery has some splendid specimens, among which is a panel of silver cloth, by a new proceeding, for which M. Moreau Christophie has taken out a patent. Upholstery and musical instruments are abundant.

Comfortable, and even luxurious arts, seem to prevail over what M. C. Dupin styles domestic arts. Magnificent carpets of the Pompadour school show the flexibility of the manufactories of Aubusson, but we should prefer to see the common carpets descend to so low a price as to render them more general in France. The walls are ornamented with stained paper, the predominating patterns of which consist of panels or arabesques, with vases of flowers or Gothic medallions in the middle.

The blinds suspended at different windows show the progress of this branch of manufacture. The glass manufactory of Choisy has exposed some bouquets of glass and paintings of the same materials, which appear to us perfect as regards the brilliancy of the colours.

The articles of Parisian manufacture occupy a conspicuous place in the exhibition. They consist principally of ornamental objects, upholstery, furniture, mirrors, stained paper-hangings, carpets, &c. Among the latter we noticed in particular those embroidered with the needle.—*Abridged from the Times.*

NOTES AND NOTICES.

New Method of Working Caoutchouc.—The employment of either spirits of turpentine, the volatile oil of caoutchouc, balsam of copavia, and the oils obtained from gas-works, as solvents of India rubber, have the disadvantage of being expensive, and of producing a varnish which dries with much difficulty. For some time past ammonia has been used with advantage. The gum elastic, cut up into shreds, is covered with caustic ammonia and left in this state several months. The ammonia becomes brown, and the gum assumes a brilliant and silky appearance, resembling a fresh nerve. The caoutchouc swells, but is still elastic, and resembles very closely beautiful silky threads, when drawn out, but it breaks more easily than raw caoutchouc. In treating this swelled caoutchouc with spirits of turpentine, it is easily converted by agitation, into an emulsion, and in a short time it swims on the surface like butter on milk, after this it acts like varnish. But a much smaller quantity of spirits of turpentine is sufficient to dissolve it than when it has not been softened by ammonia.—*Annales des Mines.*

Planispheres.—Sir, I take it for granted, that when Mr. Howell states, in your 821st Number, that in the beginning of 1837 he constructed the planisphere, of which he there gives so meagre and imperfect a description, he did not mean, in using the word "constructed," to imply that he had *contrived* it; because, had he done so, the assertion would have been extremely difficult of belief, for two reasons; first, from the fact that such planispheres (*correctly constructed*) are to be met with at all the map and chart shops; and secondly, from the numerous errors and inconsistencies in Mr. Howell's description of it, which any person who really understood its construction, much less one who had contrived it, could scarcely have committed. * * * I have in my possession a beautifully printed copperplate planisphere, purchased several years since at a seaman's slop-shop in Liverpool; it is in every respect similar to the one in question, except that in place of the clumsy cross-sticks, there is a strong pasteboard back, on the margin of which an hour-circle is marked, and on which the other parts revolve. It consists of three parts only, and may be kept in a portfolio. It is a most convenient and excellent instrument for acquiring a knowledge of the heavens and the names of the stars, fully deserving all that can be said in its favour; and as it certainly may, with proper directions, be constructed by any person (though scarcely in a couple of days), I shall be happy, if you or your correspondents desire it, and unless Mr. Howell previously amends *his* description, to furnish a few short but methodic directions for its construction.—NAUTILUS.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough-court, Fleet-street.*—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

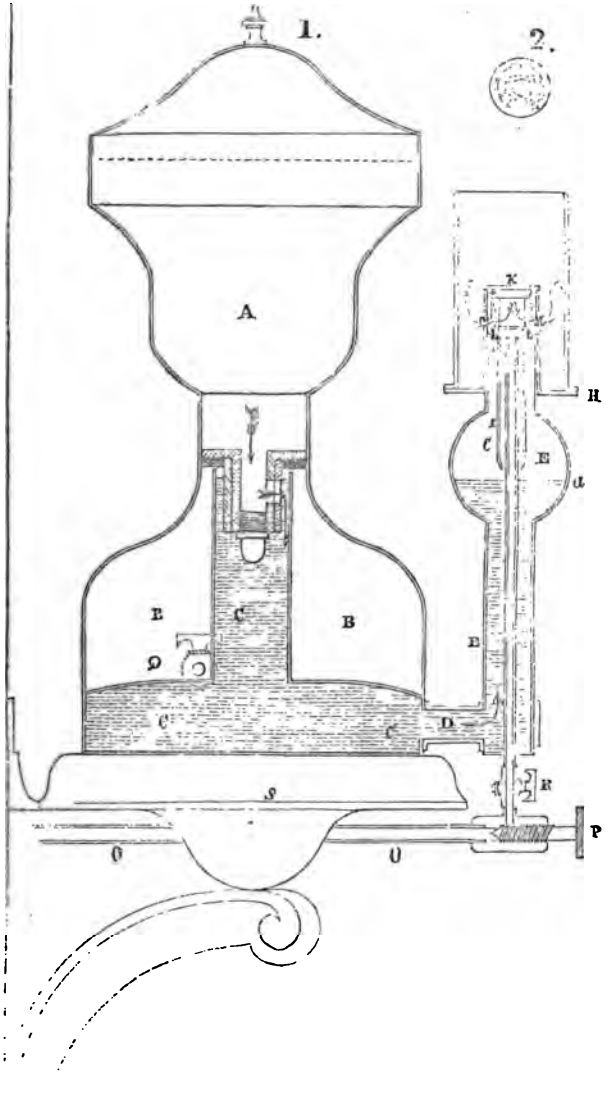
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 825.] FRIDAY, MAY 31, 1839. [Price 6d.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

MESSRS. BEALE AND CO.'S AIR AND VAPOUR LIGHT.

Fig. 1.



MESSRS. BEALE AND CO.'S NEW AIR AND VAPOUR LIGHT.

In the year 1834, Mr. Joshua Taylor Beale, the author of many ingenious inventions, both chemical and mechanical, patented a lamp for burning the commonest hydrocarbon obtained from coal tar. Though this invention was allowed to possess much merit, and to be useful for many purposes, and had cost its author twenty years in experiments, it was not applicable to general purposes, nor was it without imperfections.

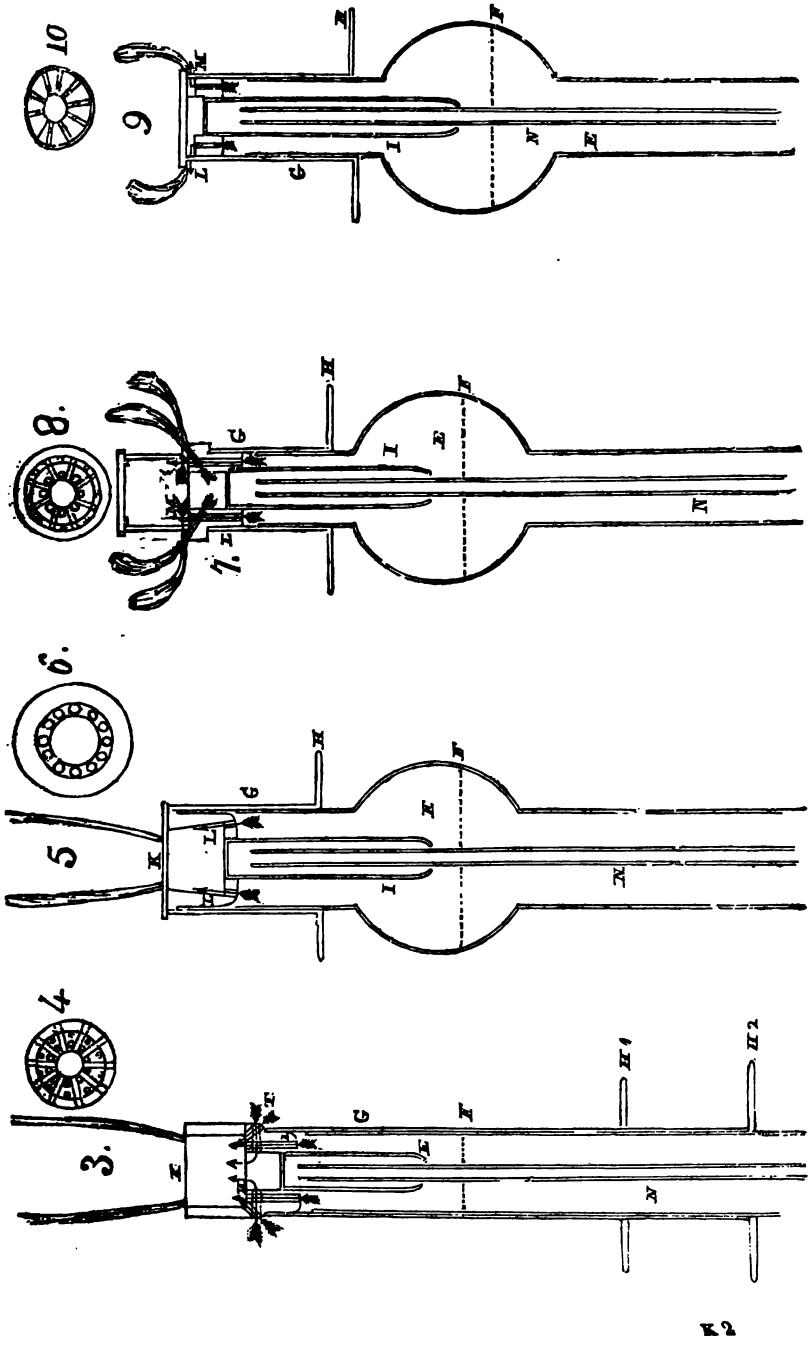
The new invention patented in December, 1837, also by Mr. Beale and others, has no resemblance to the former one, and may fairly be esteemed one of the most interesting and important discoveries of the day. Beale's first invention consisted in a cup, into which the hydrocarbon flowed from a reservoir, and in which the fluid was lighted by the assistance of a little spirit, and by the means of a dome afterwards adjusted, while a supply of atmospheric air, under a strong pressure, supported a blast, and kept up a perfect combustion. But the present system, as will be shown, is not to burn the fluid, but to form it into vapour, in a sort of retort, and to mix that vapour with a certain quantity of oxygen from the atmospheric air. It is therefore called the "*Air* and *Vapour* Light."

The merits of this invention (the result of protracted perseverance and great expense) are the production of a brilliant light at much less expense than any thing hitherto known, of more intensity by far than those from ordinary gases, consequently producing more light with less flame, which, in many instances, is a great advantage, and from substances, one or other universally to be met with, at little expense.

The substances from which this light is obtained, are the fluids resulting from the distillation of tar, either vegetable or mineral, and that produced by coking, or the destructive distillation of coals, resin, turpentine, mineral naphtha, asphaltum, pitch, various bitumens, caoutchouc, animal and other bad oils, and most of the inflammable bituminous, oleagenous, and resinous substances. By a very ingenious, and apparently simple contrivance, the light may be said to create itself, for it is the light *that keeps up the supply* of vapour of *the hydrocarbon, which* being mixed as it is formed, with a sufficient quantity of air at a proper temperature, produces the light. This mixture of oxygen and vapour takes place in the burner, which also answers the purpose of a retort, so that the whole process of making a light similar to gas is performed at once.

In some cases it may be found advantageous to mix the supply of air with a small proportion of inflammable gas, but in the lights hitherto used this has not been done, nor found necessary. The following particular description is somewhat abridged from the specification.

Fig. 1. (on our front page) is a side section of a lamp. This burner is divided into two parts, the lower part or cup marked E is made of very thin sheet iron, thinner than an ordinary visiting card, indeed as thin as it can be made to retain its form, and is about six inches in length and five-eighths of an inch in diameter. This cup may be made with or without the globular part as shown in the different figures of the drawing. The advantage of the globular part being to allow a larger space for the mixture of air and vapour, or air and gas and vapour as the case may be. Into this cup passes the fluid through the channel marked D, as high as shown by letter F, which is one eighth of an inch more or less below the level of the top of the overflow pipe shown in the body of the lamp, over which overflow pipe the surplus fluid (in case of any leakage or mismanagement) passes into reservoir B, which reservoir should be made sufficiently large to hold the contents of reservoir A. C is the chamber which receives the supply of oil from the reservoir A, which is made to feed the lamp upon the principle of an ordinary argand reservoir lamp. Up the centre of the cup E, and through the fluid passes the small air-pipe marked N, and carried to the height shown in the figure. The upper part of the burner G which is made to slide on the lower part or cup E is made of iron or brass, and through the top part of which holes are perforated as shown in the different figures. The holes encircling the inverted tube I, and which come inside the cup E, are to admit the combustible mixture into the top part of the burner K. In the centre of K an inverted tube I, the bottom of which is contracted as shown in drawing is made to screw. The air pipe N, which passes up this inverted tube al-



K 2

lows the air, mixed, to pass into this tube which being closed at the top, consequently causes such air to be forced downwards upon the surface of the fluid, and thereby forcibly to be mixed with the vapour, which mixture then passes up through the inner circle of small holes L into the top part K, where it has again to pass through other holes as shown by the arrows in the figure, before it gets consumed. The top part of the burner K, with the inverted tube I screwed through the centre of its bottom, is placed upon the tube G. which is made to slide up and down over the inner tube or cup E so as to enable the adjustment of the distance between the top part of the burner and the fluid, which varies according to the nature of the fluid used. H the gallery which supports the glass, which is attached to the bottom part of the burner G. L the holes perforated through the bottom of the top part K, encircling the inverted tube I, and shown by the upright arrows. M the holes perforated through the sides where the combustible mixture passes through to be consumed after having passed through the holes L, and shown by the horizontal arrows. O is the main air-pipe into which the small pipe N is fixed in order to receive the supply. P a regulating screw acting as a cock to adjust the supply of air. Q a cock for drawing off the overflow from reservoir B. R a small cock to turn the air on and off. S a bracket supporting the lamp.

Fig. 2 shows a plan of the perforations used in the burner fig. 1. This lamp may be variously modified, in confirmation and a few varieties are shown in the figures 3 to 10. The object being, whatever be the shape given to the burner, to supply a regular sufficiency of heat to the upper part of the fluid in the cup, and to regulate the rush of air, or air and gas, according to the evaporation taking place.

Fig. 3 shows a burner with an upright light with the head of the top K open. It has a third series of holes perforated marked T in the direction shown by the angular arrows. The cup E in this burner being made without the globular part (the sliding tube G is brought down to the part marked H^2) H^1 is the gallery for the glass which is made to slide up and down over the sliding tube G.

Fig. 4 shows a plan of the perforations used in this burner.

Fig. 5 shows a burner with an upright light with only one series of holes L shown by the upright arrows. The top part K is open at the head and slightly contracted. This burner is not adapted for so large an admixture of gas with the atmospheric air, as the others will admit of.

Fig. 6 shows a plan of the perforations used in this burner.

Fig. 7 shows a side light in most respects similar to fig. 1. The figure clearly showing wherein it chiefly differs. viz. : by another row of lights proceeding from the holes shown by the arrows drawn at right angles and pointing upwards.

Fig. 8 is a plan of the perforations used in this burner.

Fig. 9 shows a side light burner, with the holes L and M closer to the top.

Fig. 10 is a plan of the perforations used in this burner. When the size of the lamp or burner is much increased, it has been found useful with some of the oils to fix fangs and prongs to the end of the inverted tube, so as to dip into the fluid to promoting the evaporation.

When atmospheric air alone is used, and it is wished to burn the coarser volatile oils, the burner is first heated (which is not necessary with the finer volatile oils) so as to produce sufficient vapour to become combustible, and to do this, a little very fine volatile oil, such as coal tar Naphtha of the better kind is poured into that part of the burner called the cup upon the coarser oil, after which the atmospheric air is turned on, and a light applied to the issue of mixed air and vapour. This method of lighting the lamp need not be resorted to when a mixture of air and inflammable gas is used in such proportions as will render the mixture inflammable when flame is applied, which will heat the burner and cause the vapour to rise, after which the light becomes regular and bright with the assistance of a proper pressure on the air-holder.

Following the description of Fig. 1, it will be seen that this burner is so constructed as to take and retain, by an easy adjustment, any required degree of heat, whereby a regular quantity of vapour is formed, and a proper portion of atmospheric air being admitted by means of a cock, the combustion is made complete, and the light, which is in consequence quite free from smoke, continues without variation. Should indeed any great alteration in the degree of tem-

perature take place, that would have a trifling effect; but this can instantly be corrected in one, or any number of connected lights, either by raising the burner a little further from the fluid, or adding to the pressure of air, when the temperature has greatly increased; or by lowering the burner nearer the fluid, or lessening the pressure of air, when the temperature has become materially colder.

The hydrocarbons are contained in a reservoir connected with the burner, and are allowed to flow into it to a given height; an overflow is provided for, either in the reservoir or the burner itself, to prevent the possibility of any material rise of the fluid in the burner, which would cause too great a production of vapour, and require a larger quantity of air, or produce smoke or other more serious consequences: but the possibility of an overflow can be avoided without any inconvenience, by the fluid being made to rise from an under reservoir by the various means known and practised in oil lamps. The air is introduced by means of a small tube, which passes through the fluid in the burner, and is thus forced up an inverted tube fixed to the top, to receive a certain degree of heat, and then return down upon the fluid to mix with the vapour, and afterwards to escape for combustion. The air may be supplied to the different lights in an establishment by the means of pipes, in the same way as gas, through which it is forced from a reservoir or feeder, under a pressure of about half an ounce to the inch; or when the lamps are made portable, the self-acting air-feeder can be placed in the bottom of the lamp, or compressed air used by means of proper arrangements.

Models of all these lamps are now making under the directions of M. du Maurier, to be submitted to every scientific body in Europe and America.

To form an idea of the expense of this light, it is necessary to examine the quantity and cost of the material consumed.

The consumption of air, which is about four cubic feet an hour, will cost the wear and tear of the air-holder or bellows necessary for its supply.

The quantity of fluid consumed by each burner, giving a light equal to that furnished by the consumption of fifteen feet of gas an hour, is at most 2½ ounces per hour; consequently, 1670 ounces of fluid, little more than a gallon (which weighs about 150 ounces), will furnish as much light as 1000 feet of gas. The average price of coal-tar in London is two pence per gallon, and many gas companies in England and elsewhere are glad to give it to any one who will fetch it away. The average quantity of useful fluid obtained by the distillation of coal-tar is about 25 per cent.; that of Lancashire, 60 per cent.; some yield but 20. One hundred gallons of tar at 2d. would cost 16s. 8d.; suppose 25 gallons of hydrocarbon are taken from the hundred gallons of tar, and that 10 are wasted in the process of distillation, there would then remain 65 gallons of pitch, or in weight, 650lbs.; this, at only 3s. the 100lbs., would produce 19s. 6d. deduct from that 5s. for the first distillation, and 5s. for the rectification of the 25 gallons of fluid, the product will be 9s. 6d. for pitch, and at least 20 gallons, 10 of best fluid, and 10 useful hydrocarbon, which would have cost the difference between 9s. 6d. and 16s. 8d., say 7s. 2d.

If the bitumen pavement succeeds, large quantities of pitch will be wanted, and the gas companies will probably raise their prices; but this would in no way affect the value of the hydrocarbons, for the paving companies must reduce the tar to pitch by distillation, and have no other use for the fluids which they are obliged to abstract, than that furnished by this discovery, of which the consequence is advantageous to the gas companies as well as to the paving companies, and others using pitch in quantity. The former will get a better price for their tar, and the latter will get their pitch cheaper than if there was still no demand for the hydrocarbon which they are obliged to extract. But a much greater advantage is open to the gas companies by this invention, and by which they will be enabled to make a saving of 80 per cent., namely, by burning in these lamps the dregs of the hydrocarbons, and which can be done with the assistance of 15 per cent. of gas mixed with air, that is to say, 15 feet of gas and 85 air, which mixed and passed through the burner with fluids that are so heavy that they will sink in water, produce a much more intense light than the best coal gas.

The oil of resin is equally good and cheap for this purpose; 100lbs. of resin distilled, produce 90lbs. of fluid, which rectified, will yield 80lbs. or 8 gallons, at about a shilling a gallon; but this would of course cost less in those countries where this article is produced in abundance. M.

EXPERIMENTS ON STEAM AND THE STEAM ENGINE, BY MR. JAMES SCRYMGEOUR.

Sir,—I herewith send you a detailed account of a series of experiments on steam, which I completed several years ago, after a great deal of labour. It has hitherto been unpublished, in consequence of the results I obtained differing so much from established authorities. But as "established authorities" have lately been found to be very considerably in error, the disparity of the results, I trust, you will not consider as any proof of incorrectness. Subsequent observation and experience have confirmed me in my opinion of the rectitude of my experiments. Your liberality in publishing opinion has greatly stimulated men of science to free inquiry, and added much to the spread of truth upon mechanical and philosophical subjects, correcting various errors of the learned as well as the unlearned. I expect that you will add what is contained in this paper to the list.

I am, Sir, yours respectfully,

JAMES SCRYMGEOUR,
20, Glassford-street.

Glasgow, 8th Oct. 1838.

Experiments.

About two years ago I constructed a small engine for the purpose of ascertaining whether steam might be employed with advantage in a manner similar to that in which Mr. Stirling used air in his engine, with this difference, that it was to be employed with a pressure of three or four atmospheres. The cylinder is four inches diameter, and twelve inches stroke, with two steam vessels ten inches in diameter, and sixteen inches in length, with hemispherical ends, with a plunger or displacer in each nearly half the length; thus allowing fully more than one half of each of the vessels to be occupied with steam to be contracted by cold, or expanded by heat. The upper ends of the vessels were heated and the lower ends were kept at a lower temperature. The cylinder was likewise heated to as high a heat as the upper ends of the vessels, so that the steam should not contract when it entered it. The displacers were worked up and down like the valves of a common engine, and displaced the steam from the cold ends to the hot alternately. One of the vessels communicates with the lower end of the cylinder, by which the lower side of the piston is acted upon, and the other with the upper end of the cylinder by which the upper side of the piston is acted upon; thus using for a power the contraction and expansion of the same steam. From some experiments which had been previously made, steam appeared to expand more than air, for the same difference of temperature.* It is likewise quicker heated and cooled than air (this is inferred from air being known to be a worse conductor of heat than steam), and that the vessels could be easier charged and kept at the required pressure, and the leakage more easily supplied, by means of a small boiler which was attached to the engine. But upon trial it was found that its property of quickly acquiring a change of temperature, which is so answerable for this mode of obtaining power, was the occasion of its failure; for that property principally depending upon its conducting power, no sufficient difference of temperature could be maintained between the ends of the vessels.†

Previous to constructing the engine I was doubtful whether steam would answer the purpose, and calculated so that air might be employed, for which purpose the expansion was tried, under a pressure of a column of mercury of fifteen feet three inches high, to ascertain if it would expand as much under this pressure, as at that, of the atmosphere. For that purpose an iron pipe was employed with a glass bent tube sealed at the one end, and bent up parallel with the tube: the sealed portion was nearly

* The following more correct experiments related after this will show what is here meant. They were made after the trials with the engine.

† The displacers in each vessel would require a valve fashioned upon the end of each, like a pot lid, so as to stop the communication with the cold end while the steam is in the hot, because the steam is condensed by the cold end as fast as it is expanded by the heat, the communication being open.

six inches long, and about three-tenths of an inch bore. Being then filled with mercury, including the air in the sealed portion, the included air was thus compressed into the space of seven-eighths of an inch; the tube was somewhat smaller towards the sealed end. The temperature was 61°. It was then immersed in a vessel nearly full of oil, and the temperature raised to 312°. The air expanded about three-eighths of an inch, and raised the column of mercury along with it, being nearly at the same rate of expansion as at the atmospheric pressure. From this it was calculated, that if the air vessels contained about four times the cubic contents of the cylinder, and charged with air equal to the pressure of four atmospheres, that is, when the air is in the cold ends of the vessels, that a sufficient heat might be applied to the other end of the vessels, to cause an expansion when the air entered it of two additional atmospheres, or equal to the pressure of thirty pounds to the square inch on the piston at the commencement of the stroke, and at the termination about two pounds. This unequal pressure might be modified by using two engines, and with vessels of a larger proportion to the cylinder. But from what was observed in the using of steam, I gave up the thoughts of obtaining any advantage or saving by the contraction and expansion of air or steam over the steam engine in common use, when carefully used.

I now felt a desire to ascertain more correctly the expansion of steam than what had been previously done.

Experiment 1.—The first method and apparatus now employed for high pressure, was the same that was employed to ascertain the expansion of air under pressure. But the iron pipe was cut to the length for the pressure immediately wanted, and a glass tube cemented upon the top of it, so that the top of the column of mercury might be seen, and the progression and the extent of expansion measured. A drop of water was introduced into the sealed end of the bent glass tube above the mercury, before it was cemented to the iron pipe; after which the heat was raised to 450°, the highest temperature which was intended for the experiment being always much above that which water could exist for the pressure employed, and the superfluous water made its escape round the bent of the tube.

The following is the progressive expansion under the pressure of a column of mercury, commencing with 112 inches, and terminating with 120 inches: it began to form steam at the temperature of 302°, and continued to form it and expand to that of 320°. At this temperature all the water was formed into steam, and its greatest rate of expansion terminated. The expansion of the steam above this point was nearly the same as air, until it reached 400°, when the rate of expansion, I thought, perceptibly decreased; the temperature was raised to 450°. When allowed to cool it began to contract rapidly at 312°, and was condensed at 292°.

The difference, amounting to eight degrees of temperature between the termination of the point of its greatest expansion and the commencement of its contraction again when cooling, is mostly occasioned by the time required for the heat to pass through the glass tube, and the friction of the mercury in the tube. The time elapsed in raising the heat from 302° to 320°, was between two and three minutes, and the time of cooling nearly the same.

Experiment 2.—A wider piece of glass tube was cemented upon the top, and a rod of iron of a proper size plunged into the mercury to raise it to the same height and pressure of 120 inches at the commencement of the formation of steam, and the iron gradually withdrawing as the steam expanded, so that at the termination of its greatest expansion it was just subjected to the same pressure as at the commencement. Steam began to form at the temperature of 306°, and at 312° all the water was converted into steam, and its greatest rate of expansion terminated: the column was then raised about three inches in the upper glass tube. In cooling it began to contract rapidly at 306°, and terminated at 300°, when it was condensed. The above result was the mean of several trials. In these experiments the heat was kept stationary for a minute or two, when the steam began to form, and at different degrees above 306° to 312°, but at the temperature of 306°, when it commenced, and raised the column of mercury more than one half of the space of three inches, it did not remain stationary

at any place between that and the commencement. But in the upper portion, by a little care in regulating the heat, the column of mercury was made to remain stationary at any place, with a corresponding increase of temperature, but with a decreasing rate of expansion. The progressive contraction in cooling was similar to the expansion, but no very exact measurements could be obtained, by reason of the fluctuations experienced in the different trials of heating and cooling. The principal cause of these fluctuations was from the steam condensing sometimes upon the side of the glass tube, and the mercury rising up and covering the condensed particles, and not pushing them before it to the end of the tube, particularly if quickly cooled. These particles which condense upon the sides of the tube do not rise into steam again until the mercury be pushed off them, when they cause a small but sudden rise of the column; this is best observed at low pressures.

There is still a difference of six degrees of temperature between the commencement of forming steam and the condensing by cooling, which is probably occasioned by the friction of the mercury in the tube, although frequently tapped with the hand. If we allow three degrees of temperature to overcome the friction both up and down, the temperature would then correspond when expanding and contracting, the one 303°, and the other 309°.

Experiment 3.—Under sixty inches of mercury steam began to form at the temperature of 272°, and its greatest expansion terminated at 276°. These temperatures were the mean of several trials, and are corrected for the friction of the mercury, as in the foregoing experiment, to which the same observations will apply.

Experiment 4.—Under eleven inches and one-half of pressure of mercury, steam began to form at the temperature of 230°, and terminated its greatest expansion at 235°, the pressure then being fifteen inches. It was afterwards adjusted to eleven and one-half inches at the commencement and the termination, notwithstanding it required about the same degree of heat, namely 235°, before its greatest expansion terminated.

The expansion of the steam was tried up to 450° of temperature, and found to be the same as air, without any decrease in the rate of expansion, which was observed under the high pressure.

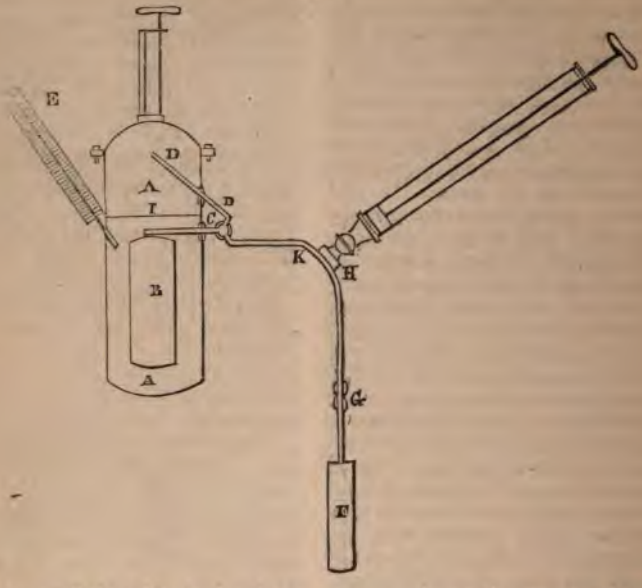
Experiment 5.—Under a pressure from one to two inches of mercury. The bent tube in this case was formed with a globe about one inch in diameter for the bent up part, and another globe of the same size upon the open end, the bend being between the globes, so that both were at the same height: the open end above the globe was about twelve inches long. The globe forming the sealed end was filled with mercury, and likewise round the bend, and then a little water was introduced above the mercury; the other globe and about two inches of the tube were filled with oil. By these means the top of the column was seen above the oil in the vessel used for heating it. By this arrangement, when the water began to form steam, it was then at a pressure of one inch of mercury below the atmosphere, and terminated its greatest expansion at two inches above it, including the weight of the oil. The oil was used that the expansion might be easily seen, without materially increasing the pressure. The temperature was first raised to 220°, and the superfluous water expelled, then allowing it to cool. Now, when the heat was slowly raised and the steam began to form, the oil rose quickly to near the one-half of its range, equivalent to the half of what the globe contained. It then dropped down slowly nearly one-third of what it had risen. While the heat was still slowly rising, it vibrated in this manner up and down two or three times, before the globe was filled with steam; but when the temperature was a little quicker raised it would only stop once; and when quickly raised the column of oil would dart up to the extent of the greatest expansion of the steam, as if it had been a solid body which had got a smart impulse, and remained; the temperature rising quickly prevented its returning. Its greatest expansion in this case terminating about two or three degrees above that at which it began to form steam, a degree might have been sufficient, if no increase of pressure had taken place. In repeating the above experiment, a small quantity of oil got round the bend into the globe by accident, and mixed with the water which formed the steam, and I was much surprised, when raising the

heat again, to find that it did not expand and raise the column of mercury as formerly; for, although the temperature was raised to 240°, it did not expand to the half of its former bulk. This experiment was repeatedly tried, but with similar results; from which it may be inferred that the use of oil or grease in the cylinder of the steam-engine would reduce the expansion or volume of the steam.

These results led me to inquire whether the boiling point of water would be raised, being covered with oil or tallow, for which purpose I tried the temperature of a tallow chandler's pan. There was between twelve or fourteen inches in depth of tallow at the time, with a large pail full of water. After the pan was allowed to boil about ten or fifteen minutes, and when it came to its maximum degree of temperature, which was 220°, being eight degrees higher than if there had been no tallow mixed with the water. In one experiment with the bent tube, before the one with the balls occurred to me, oil was used (it happened to be sperm oil) by which the expansion of the steam could be tried at a proportionably less pressure than with mercury. But in this case it required some little management to fill the sealed leg with steam, as the drop of water lay in the bend; but holding it a little off the perpendicular it was accomplished. The drop of water in this situation did not begin to form steam until the temperature was raised some degrees above 230°, and that but very slowly, until it was raised to 240° or 250°; but I was much surprised at the length of the time required to expel the superfluous water in steam, after it had filled the sealed leg, and the quantity that appeared to escape. To hasten the process the temperature was raised to above 260°; it was then escaping in large bubbles very rapidly, in consequence of which it twice exploded (during the first trials which lasted about two hours), and drove out a considerable portion of the oil at each time. But the tube was refilled with the same kind of oil, and I at length began to suspect, from the gradual sinking of the oil in the tube, that there was something more than steam from the water escaping; indeed there was but a small *quantity of the superfluous portion, after filling the sealed leg, which might have been evaporated* in ten or fifteen minutes. After carefully examining it, and repeating the experiment at different times, it was found that the oil was decomposed or formed into vapour at the bend or lower part of the tube at the surfaces of the steam and oil, occasioned, as I thought, by the action of the steam upon the oil; for when the tube was suddenly taken out of the heating vessel, the vapour was seen foaming there in bubbles. The same experiment was tried with tallow, but the bubbles did not continue to be given off for above half an hour, which might be required to evaporate off the superfluous water; although there were some experiments in which the vapour continued to be given off for a longer time than what I thought might have been necessary, but it ultimately ceased. From these experiments, however, it was perceived that steam expanded considerably for the first few degrees of temperature above that at which it is formed; but by this manner of experimenting the amount could not be ascertained. Another method was then employed, by which the exact amount of expansion might be obtained.

Fig. 1 is a drawing of the apparatus first employed for that purpose, which was to obtain in the first place, the density of steam at the temperature which it is generated, the density being equivalent to the expansion, and likewise the temperature was taken as equivalent to the pressure in the following extracts; A A is a vessel made of copper 4.4 inches wide, and about ten inrhes in depth with a safety valve at the top; B is the measure, five inches long and two inches wide, which contains 4348 grains of water at 60° of temperature, it is fixed in the centre of the boiler by the pipe communicating with the stop cock C, this pipe is soldered to the side of the boiler where it passes through; D D is another pipe passing from the stop cock throught the side of the boiler, where it is likewise soldered, and terminates near the top of the inside of the boiler; F is the condenser one, and one-half inches in diameter and five inches long; K the pipe which leads to the condenser; H where the air-pump was screwed to; G is the place where the condenser is joined with this pipe; this joint is formed by the one end being ground into the other, so as to be readily twisted off, but it was found ne-

Fig. 1.



cessary to use a little white lead to keep it sufficiently air-tight. There was a thin tube with a close bottom soldered into the side of the boiler, inclining downwards until it nearly touched the measure, into this tube the thermometer E was inserted with a little grease to complete the contact; I is the height of the water in the boiler. This boiler was enclosed with iron which included the stop cock, and at about an equal distance from the boiler all round. To the bottom of this iron enclosure a pan was fixed containing wood charcoal for heating the vessel, and there was a small rod attached to the plug of the stop cock which passes through the iron enclosure to turn the stop cock which is what is generally termed a three-way cock.

The condenser was constantly immersed in a tub of cold water, when the boiler was first filled with water to the height of I, which fairly covered the measure B. I expected from this arrangement that the inside of it would be raised to as high a temperature as the steam given from the water, but upon trial it was found not so at the high pressures. After the boiler was raised to the heat *wanted, the air was* expelled from the *measure, by repeatedly filling* it with steam; the condenser was then twisted on, and immersed in a tub of cold water, the air was then extracted from it, and the tube by the air-pump. Next a certain number of fills of the measure of steam was condensed into the condenser, it being previously weighed; the weight of the condensed steam was thus obtained, and of course its expansion. In these experiments the temperature was taken for the pressure. It was my intention to use a gauge to show the pressure by the compression of air, for which purpose a bent glass tube was employed similar to what is commonly used for such purposes. But to get as great a range between the atmospheres as could be conveniently obtained, the portion containing the air was fashioned with a small bulb about an inch above the bend, which would comprehend the compression of the first atmosphere; there was another smaller bulb at the top of the tube. It was calculated that for the number of atmospheres of pressure required, that the mercury would not reach the bulb at the top, the distance between the bulbs was about nine inches, the effect of the bulbs was to reduce the length of the tube to about one-half, from one of an equal width throughout. In this

case the atmospheres had to be marked off by trial, after a sufficient quantity of mercury was put into the gauge, so that the surface of it stood when only under the atmospheric pressure, at the foot of the lower bulb. It was then cemented to an iron tube of sufficient length, and small holes bored in it at thirty inches distance, commencing from the surface of the mercury in the gauge; the first thirty inches raised the surface of the mercury about half an inch above the lower bulb as was intended, it was then heated up from 54° the temperature of the air, to about 95°, a mark being made at both places; it was thus tried for each thirty inches of mercury added; it was then allowed to stand, with a hundred and twenty inches of pressure for about twenty-four hours, when it was observed by the marks that the air had contracted a little. The mercury was then let off by thirty inches at the time, and the gauge heated and allowed to cool at each time, and the loss or contraction of the air appearing to increase, for when at the atmospheric pressure the surface stood within a fourth of what the first thirty inches of pressure compressed the air at first, indicating an absence of three-fourths of the half of the air, and vapour at first contained in it. There was a considerable quantity of moisture in the gauge at first, and there appeared to be rather less after the experiment; there was then a quantity of black oxide of mercury coating the inside of the lower bulb, and covering the surface of the mercury. I suppose that the mercury had decomposed the vapour or air, when exposed to the heat and pressure employed. The mercury was quite clean when introduced, and no appearance of oxide until letting off the last thirty inches of pressure, nor any appearance of air passing the mercury. Finding so great a variation I lost confidence, and trusted afterwards to the thermometer which was found very suitable.

In the first trial of the apparatus the communication was allowed to remain open seven or eight seconds between the steam in the boiler, and the measure after the noise of the steam rushing into the measure had ceased. The following are the densities of steam given by this method, *which plainly shows that steam slowly condensed just in proportion to the time that the communication is left open.*

The following results are the mean of several trials:—

Temperature.	Expansion.
212°	949.5
249°	480.4
273°	350
290°	254.5
308°	144.6

The densities for 212° was obtained by keeping the safety valve open, and allowing the steam to escape freely, under these circumstances, the result was but little affected by the length of time, the communication was allowed to remain open between the boiler and the measure. The next point was to ascertain what would be the density or expansion of steam by shutting the communication immediately after the noise of the steam rushing into the measure had ceased.

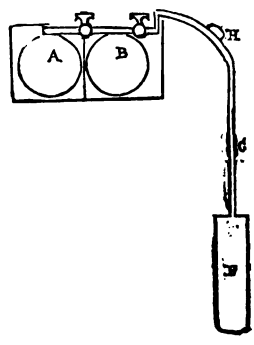
The results are the following:—

Temperature.	Expansion.
212°	949.5
249°	662.4
273°	475.6
290°	374.1
307°	280.7

These results I conceived to be near the truth, notwithstanding the subject was left in doubt. After some reflections, another plan suggested itself to me by which a nearer approach to the truth might be made the principle was to expose the boiler and the measure to the same degree of temperature.

The following is a description of the apparatus fig. 2; A is the boiler; B the measure, both of the same size and

Fig. 2.



shape, made of thin copper tube, and one-fourth inches in diameter, with hemispherical ends, and three and a half

inches long including the ends. The bar between them forms the pipe of communication between the boiler and the measure, and from that to the condenser, it likewise contains the stop cocks.

The stop cock E stops the communication between the boiler and the measure, and the stop cock I between the measure and the condenser.

K the pipe which leads to the condenser; H, the place where the air-pump was screwed; G the place of joining the condenser F with this pipe. The boiler was filled about three-fourths full of water, and the aperture that admitted the water was then soldered up with tin. The boiler, and measure with the stop cocks were immersed into a vessel nearly full of oil, which covered the barrels of stop cocks. A thermometer was immersed in the oil touching the boiler. The vessel with the oil containing the measure, and boiler were kept steady at the temperature required, by a pan containing charcoal, as with the first apparatus, and similarly enclosed. The atmospheric air was driven out of the measure by the filling and emptying it of steam before the condenser was twisted on; it was then twisted on and immersed into a tub of cold water, and the air extracted by means of the air-pump: a certain number of fills of the measure were condensed and weighed as formerly.

By this arrangement and form of the apparatus, the boiler and measure were exposed to the same degree of heat; the safety valve was soldered up, as it occasioned a considerable error by small leakage at the high pressures, which kept the boiler at a lower temperature than the measure, thus preventing leakage, excepting what passed to fill the measure. After many trials it was found that if the stop cock between the boiler and the measure was allowed to remain open for one minute at each fill of the measure of steam, the boiler acquired the same degree of temperature with the measure, the boiler and the measure being within two-tenths of an inch of each other, and the oil kept frequently in motion by means of a small blow pipe, thus keeping the vessels surrounded with a medium of equal temperature; by these means *the density of steam at the various temperatures and pressures were* exactly ob*tained, and at the temperature* which it *rises from the water.* The measure contained 2947 grains of water, at the temperature of sixty. The following quantities are what I have assumed for the expansion of the copper measure 212° 2958 grains .273° .2963 .310° 2967 grains; the rest in the same proportion. There were ten fills of the measure taken for each weighing. The air was extracted by the air-pump at the commencement of each time, and a few strokes were made at the end of the first five fills, and any other precautions were employed that appeared necessary to prevent error. Ten fills of the measure at 212° gave 34 grains of water, equal to an expansion of 870, at 250.5 gave 58 grains, 510.5 expansion; 293° gave 87 grains, 340.8 expansion; 332 gave 127 grains, 2337 expansion; 346° 147 grains 2021 expansion. The expansion being deduced from the density, or in a tabulated form thus :—

Temperature.	Grains	Expansion.
212°	34	870
250.5°	58	510.5
293°	87	340.8
332	127	233.7
346	147	202.1

There was a considerable difficulty found to get the stop cocks sufficiently tight; after a number of trials of different metals it was found that barrels made of block tin answered best. The original holes in the brass, for the barrels were pretty wide, they were tinned in the inside, and the block tin cast, and thoroughly fused in them. A small wire being fixed in the middle of the pipe to form the hole of communication through the tin, the holes were then bored in the centre of the tin for the plugs, about two-tenths of an inch in diameter, which left a sufficient body of tin round to form the barrel. The plugs were made of a composition of copper and tin, pretty hard, they were turned, and carefully ground in a hole in brass, and burnished up in a turning lathe to a bright surface. The holes in the tin were opened nearly to the size and shape of the plugs, the plugs were then twisted and wrought in quite clean with a little moisture, until the holes had acquired a bright surface throughout. The hole of communication was bored in the proper place of a small bore, about that of a middle sized pin, the hole in the tin being previously cast. By these means an almost perfectly tight stop cock was obtained, and

comparatively little or no appearance of tear and wear observed, during the whole of the experiments. By the method already described, the density of steam at the temperature of the water was obtained. The next step was to ascertain the density of steam at 10° of temperature above the water from which it rose, and yet to be exposed to the same degree of pressure. The vessel for holding the oil for this experiment was composed of two separate vessels, made a half cylinder each, so that when the two were put together they formed a vessel about the size of the former one, with a division in the middle. There was a notch made in of the division, so low as to permit the middle stop cock with the communicating pipe low enough to be covered with oil to as great a depth as in the former vessel. The upper edges of the two vessels forming the division were soldered together, and likewise along the edges of the notch which admitted the stop cock and the pipe, thus preventing the oil from running out or getting between the vessels. Their bottoms were held together by a plate soldered to each, there was still a little distance between them, about as much as would have admitted a fold or two of common writing paper. By these means the communication of heat between the two vessels was considerably impeded, when the boiler and measure were introduced into them, the division mentioned went between them, so that the boiler was in the one vessel and the measure in the other. The vessels were filled with oil, and the apparatus was immersed to the same depth of oil as in the former experiments. A thermometer was placed in each vessel, the one by the side of the boiler, and the other by the measure, and during the experiments the heat was so managed that the vessel with the measure, was kept at fifteen or twenty degrees of temperature higher than the other vessel containing the boiler. But from the small communication between the boiler and the measure by the pipe, I did not estimate that the measure would exceed ten degrees higher than the boiler. The fills of the measure were wrought off in the same time and manner as in the former experiments.

The following is the result or expansion of steam for the first ten degrees above that at which it is generated, and under the same pressure.

Temperature.	Grains.	Expansion.
212° + 10°	17.5 =	1690.2
250° + 10°	34 =	870.8
293° + 10°	64 =	463.2
332° + 10°	108 =	274.9
346° + 10°	131 =	226.7

Now, at the temperature of 212°, or the pressure equivalent to that temperature, the steam in the measure was at 222°, which was steam at 212° heated ten degrees, this gave its expansion for the first ten degrees immediately above that at which it is generated.

From these results it will be seen that steam at 212° nearly doubles its volume for the first ten degrees of additional temperature; but this rate of expansion rapidly decreases for steam generated at higher degrees of temperature. For steam 346°, the expansion for the first ten degrees of temperature does not amount to above one-eight of its original volume. This will form the principal reason why less fuel is required to produce the same power with the high-pressure engine than with the low, and likewise shows, with what is already known of steam, that there would be little or no difference if both were rightly used.

It was always found, that when two-thirds or more of the boiler was filled with water, that when the stop-cock was opened, and the steam permitted to flow out of the boiler, at that moment the safety-valve was blown up, and more steam escaped, but just for a moment, and then ceased; this happened more particularly when working at high pressure, even although the safety-valve was loaded nearly two atmospheres above the pressure of the steam at the time, but this action decreased as the boiler emptied of water.

It appears to me, that when steam begins to generate with any sudden increase, the quantity generated goes beyond what it would permanently occupy, that is, it has something like an explosive action. This may account for boilers bursting in some cases when the safety-valve is raised.

From these experiments, the most advantageous method of applying steam to the greatest advantage, will be by constructing the flue, after it passes from the boiler, so as to inclose the steam-pipe, and to be made to pass once round the cylinder. By these means a sufficient increase of temperature will t

obtained; two or three degrees will be sufficient for low pressures.

A similar plan to produce the same effect, was proposed by me, in the year 1826, to Messrs. Claude, Girdwood, and Co., engineers and machine-makers in this place.

An arrangement of this kind is now in use in some of the locomotive engines to preserve the heat of their cylinders. In these cases, and where the cylinder is surrounded by steam from the boiler by a casing, or so enclosed to prevent the radiation of its heat by non-conducting substances, the inside of the cylinder may be a little hotter than the steam which enters it, occasioned by the friction of the piston upon its sides.

Some attempts to ascertain this point were made, but I have not as yet succeeded with an engine fully loaded, and the steam unchecked. With one engine the liberty was obtained, the grease-cock was taken out and a thermometer inserted in the middle of a cork, was introduced; when the engine was put in motion, and the throttle-valve fully open, the thermometer rose 216°, but afterwards it settled down to 162°; the steam was considerably impeded by the throttle-valve, the engine was not loaded, and was doing little more than driving itself.

I have made a few experiments to ascertain what quantity of heat is absorbed by steam when raised from the temperature 215° to 335°. For which purpose an apparatus was constructed with a small boiler, having a glass tube cemented to it; this tube, after proceeding about two inches from the boiler, was bent down and up again in two portions, parallel to each other, the length of these portions being about six inches, and about one inch separate from each other. It was then bent at a right angle, in a line with the portion which proceeded from the boiler, and about an inch further on, bent down again, and about two inches and a half beyond that, and terminated in a small point. This tube was of thin glass, and about two-tenths bore, the opening at the point about the fiftieth of an inch. This apparatus was fitted up for the experiment, so that the parallel portions of the glass tube were immersed in a vessel containing oil, about eight inches in depth and two inches wide, and kept at the temperature wanted by the heat of a gas burner, a thermometer being constantly kept in it. The boiler was kept boiling by means of an oil lamp, a thermometer was fixed in it, and kept at the temperature of 215° in all the experiments. A glass vessel, containing a given quantity of cold water, having likewise a thermometer kept in it, was placed so that the point of the glass tube dipped a little below the surface of the water; the portion of the glass tube above with the bend, which was not immersed in the oil, was wrapped round with a woollen thread to prevent the radiation of its heat. The oil vessel containing the glass tube which the steam had to pass through, was in the first experiment kept at the temperature of 212°, by which the temperature of the steam, when it entered the water, would be rather below that at which it was generated.

There was 2229 grains of water at 52° put into the glass vessel, it was then placed as already stated, so that the steam condensed into it, and until the temperature was raised twenty degrees, making it then 72°; it was then weighed, and found forty-three grains heavier, the temperature of the air was 62°.

Thus adopting the same method to avoid error from the cooling effects of air which Count Rumford adopted in his experiments. The vessel with the oil and steam-pipe were raised to the temperature of 265°, the same weight of water was employed, and at the same temperature, each experiment occupying about one minute and a half; but these results may be more readily understood when exhibited in a tabulated form as follows:—

Steam at	Water at 52°	Temp.	Grs.	Grs.
214°	2229	+ 20°	2272	43
265°	—	+ —	2269	40
335°	—	+ —	2268	39

From the foregoing experiment it will be seen that steam will absorb but a small quantity of heat to cause it to expand to the termination of its greatest expansion, and still a less proportion when heated above that point. It may be likewise observed from these experiments that the latent heat of steam is a little above 1000°, and even a little addition will be necessary for what was absorbed by the glass vessel.

Glasgow, June, 1834.

THE TURK'S HEAD.—PLAN FOR A WATER METER.

Sir,—I perceive by your last week's number that the mechanism of the "Turk's head" has been lately thought worthy of explanation in the Royal Institution.

When I saw it, for the first and only time, at the Adelaide Gallery, although no nearer to it than the outer circle of a crowd of gazers, the mode by which it was effected occurred to me at once; and I believe I should, at the time, have communicated it to you, but that I scarcely deemed the subject of sufficient importance. You published, moreover, shortly afterwards, a posthumous explanation from your former correspondent, Mr. Wm. Ettrick (page 296, vol. xxix.,) from which I should have been obliged to differ, at the risk, just then, of seeming wanting in delicacy. The few hints thrown out, at the conclusion of your notice, last week, have recalled the matter to my recollection, and they are in such entire accordance with the plan I had preconceived, that I can no longer refrain from submitting it to you.

Let there be a wheel turning upon its axis within the shoulders of the figure, so that a portion of its circumference may stand above the line of separation between the head and neck. Let this wheel have a flange at its outer edge on either side, and let two segments, corresponding with the protruding portion of the wheel, and nearly of the same length, be screwed into that portion of the neck attached to the head, after the latter has been fixed in its place, so that these segments may enter into the flange at either side and secure it. The effect of this simple arrangement will be, that the wheel may be turned round upon its axis without destroying its connexion with the head, and it only remains to cut out a certain number of sectors, or hollows, in which the knife may lie while passing through. Then if the knife be inserted between the head and body, it will enter into one of those sectors; and, pushing the wheel before it, will egress at the back; the head, all the while, remaining perfectly secure. The openings in the wheel should, of course, be less than the length of the segments, and should, moreover, be so arranged, that *at the egress of the knife* at the back, another opening should be presented in front for the next passage of the knife.

This plan so nearly agrees with the conditions of your notice, viz., "that it is a lock which never unlocks, although the key (the knife) never fails to pass the wards, and move the bolt," that I cannot help supposing it is the same as that really adopted. Therefore, should your objection to publishing an explanation, still continue, be kind enough to say, in acknowledging this letter, whether or not I am in the right.

Since we have not *as yet* been blessed with the piping times of penny posting, you must excuse my including in this letter, a plan for a water meter, the invention of which was commended to the attention of your readers, some time since, by Mr. Baddeley.

In the gas meter, the different density of two fluids is taken advantage of, to measure the lighter one, by causing the vessels containing it, continually to ascend through the heavier.

It is plain that the same plan cannot be adopted to measure water, since the only fluid of sufficiently greater density than itself, is mercury; the use of which on the scale required would be out of the question. But if the operation be reversed, so that the heavier fluid be that which is measured; then the different densities of water and common air may be employed to measure the former.

In addition to the ordinary cock and ball, let a meter of the following description intervene between the pipe of supply and that of delivery, viz.:—Let the intervening piece be formed like the plug of a two-way cock, so that there shall be no communication between the supply and discharge pipes, except through the passages of the said two-way plug. Let a revolving cock be ground on to the plug in the ordinary way, with an adjusting screw, except that its motion must be extremely free; on this cock let there be soldered four radiating cylindrical vessels of a suitable capacity, opening into the cock by apertures large in proportion to the size of the vessels. If, by the revolution of the cock, each of these vessels be successively brought over the passage in the plug communicating with the supply pipe, it will become filled (due provision for the escape of air having been made); and if the

same vessels be successively presented to the discharging aperture, they will become emptied (due provision for the re-entrance of air having been made). Therefore the capacity of each, together with the number of revolutions made (to be registered by well-known means) being known, the whole quantity of water transmitted is, of course, subjected to measurement.

It now remains to be shown how this apparatus may be made self-acting. Let the aperture of supply be placed at the uppermost part of the plug, so that each vessel may be filled by the pressure of the head of water, just after it has obtained a vertical position; a common button valve placed at the end furthest from the plug will, in that position, naturally open of itself, admitting of the expulsion of the air until it is closed by the water touching a float in connexion with it. Let the aperture of discharge be at the side of the plug (at the ascending side of the cock) so that each vessel may be emptied by gravity just after it has attained a horizontal position, the same valve admitting the re-entrance of air. Thus there will be constantly an excess of weight upon the descending side of the wheel, which will therefore revolve as long as the pressure of water is suffered to be exerted through it.

I hope I have succeeded in making my descriptions intelligible without having recourse to diagrams, for dispensing with which I also hope you will give me due praise.

NAUTILUS.

Leeds, May 23, 1839.

THE TAMAR FLOATING BRIDGE.

Sir,—I have read in your valuable publication of the 9th of February, 1839, No. 809, that a silver medal has been awarded to Mr. J. M. Rendel, from the Institution of Civil Engineers, for the production of a set of drawings of the floating bridges over the river Tamar, at Torpoint, near Devonport; at the same time that high eulogiums have been bestowed upon him for the great benefit conferred *by him* on the inland communication, by *his invention*. I beg to state that Mr. R. is not the inventor of the floating bridges now at work on the Tamar, the plan was copied from a vessel which was *at work nearly 20 years* since on the Laira river, near Plymouth, where now stands an iron bridge which was erected by Mr. R. for the Earl of Morley. The vessel was worked by two men with a chain stretched across the river, and was fitted with lifting platforms or prows, to receive carriages, waggons, horses, &c., similar to those at Torpoint. The only difference between the two plans being, that the one at Laira was a single vessel worked by a chain on one side only—whilst those at Torpoint are double vessels, having a chain on each side and worked by two steam engines in the centre. The whole of the plans for those engines were furnished by Mr. Mare, engineer of Plymouth, who designed them expressly for the purpose, and although the first engine made from those plans were not furnished by Mr. M., in consequence of his tender being considered too high, he has subsequently been employed by the proprietors to *re-manufacture* a large portion of the work before they could be rendered effective; in this so much satisfaction was given that he was immediately employed to manufacture a pair of engines for a second vessel, in which he introduced some material improvements with the most perfect success.

I merely mention this in justice to Mr. M., as it is now an almost every day occurrence that individuals who have attained a certain degree of eminence, still endeavour to extend *their fame* by publishing as their own, the result of the skill and ingenuity of others.

I have crossed in the old Laira vessel in all seasons of the year, and in all weathers. She was termed a *flying bridge*, which appears to me quite as absurd a name as a floating bridge. The first copy Mr. R. made from this vessel was for the Dart river. This one was worked by a steam engine, which was designed and manufactured by Mr. Mare, and answered extremely well, but the returns not being sufficient to pay the expense of working by steam, the engine was taken out and the bridge, as it is termed, is now worked by men. The next was at Saltash Ferry on the Tamar, this one is altogether laid up for want of funds.

The only person who can claim the merit of the invention of the present floating bridge in this part of the country, is a Mr. Parker who was in the employ

of Mr. Blackburn, a ship builder at Turnchapel, near Plymouth, where the Laira vessel was built, and who furnished Mr. R. with the plan for the Dartmouth vessel, which was built at the same yard, now occupied by Messrs. Pope. The Torpoint and Saltash bridges are merely an extension of the same plan,

"Palmam qui meruit ferat."

Soliciting the favour of an insertion of the above,

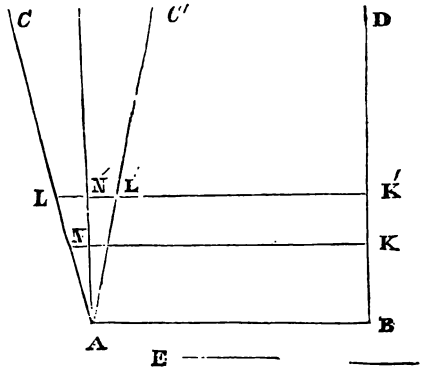
I am, Sir,

Your obedient servant,

A SUBSCRIBER.

MR. SCOTT'S DOCTRINE OF PARALLEL LINES.

Sir,—I have expressed an opinion decidedly in favour of Mr. George Scott's papers respecting the doctrine of parallel lines, given in your 20th volume, Mr. Scott's object was to remove the defects in Euclid's theory of parallel lines, which have been so long and justly complained of. The opinion I gave of the soundness of Mr. Scott's method, I still retain, notwithstanding the attempt your learned correspondent "I. K. L." has made to show that the method is a failure. "I. K. L." remarks, "although he (Mr. Scott) has proved that a certain height above A, the perpendicular L′K may, on account of the particular obliquity of the angles C′A B, C A B exceed A B, whilst L K again falls short of it; yet no evidence whatever is afforded that, at a greater height, as that of L K above A B, or even at one-tenth as great a height, the like would hold good of a perpendicular drawn to B D from a less oblique line, A N." "I. K. L." admits that, to a certain height above the point A, a perpendicular L′K can be drawn, and that the said line L′K is greater than A B when the angle L′A B is obtuse; and that L K will be less than A B when the angle L A B is acute. "I. K. L.'s" remark, that at one-tenth as great a height, &c. is so frivolous in the extreme, that nothing but respect for your learned correspondent prevents me from saying "that it is most unworthy of a geometer." Mr. Scott *has clearly demonstrated that, however near the angle* C′A B may be to a right angle, or by however little the angle C A B may exceed a right angle perpendicular, L′K, L K may be found (or do exist) above the point B, so that L′K is greater, and



L K less than A B. and that every other perpendicular that can be drawn between the points B and K will increase or diminish, as they recede from the point B: on such a supposition we can always find a line E less than B K′, and making B K equal to E, and drawing K N perpendicular to B K′, and on the supposition of K N being equal to A B, then, as Mr. Scott demonstrates, the angle N A B can neither be obtuse nor acute, and consequently must be a right angle; from which he easily demonstrates that the A N K is also a right angle, &c. Knowing, therefore, that in every case when the angles C′A B, C A B are respectively acute and obtuse, the line E may be found as above stated. If the angles C′A N, C A N be infinitely small, the line E, it may be urged, will be infinitely small; this, however, (we know from other principles) is not true, but if it was true, still a multiple of E could be found that might exceed any given line, and I beg leave to state, that I do not consider that Mr. Scott has succeeded in demonstrating the truth of his methods perfectly independent of all considerations about infinity; but if the considerations of such quantities were to be banished from geometry, very little of the important part of that science could be known.

I intended to have made some remarks upon "I. K. L.'s" statement of

Sir James Ivory's attempt (an unsuccessful one too, he states!) to solve the difficulty on parallel lines, but this I shall do in another letter.

I am, Sir, yours, &c.

J. C.

Mount-street, May Fair,
May 22, 1839.

THE LONDON FIRE BRIGADE—AQUARIUS BRIEFLY ANSWERED.

Sir,—I trust the majority of your readers will think with me, that there is very little in the last communication of "Aquarius" to which I need offer any further reply. His last letter is wholly composed of vain repetitions—nothing more than "the old story over again." It is true he attempts to raise a sneer at the *economy* with which the Insurance Companies conduct their London Fire Establishment, but every tradesman must feel this to be in reality a compliment rather than a reproach.

They, like all other traders, have a most undoubted right themselves to regulate the extent, and fix the limits of their establishment. If they have agreed to devote a certain sum per annum towards maintaining some particular portion of their establishment, the more efficient they can make that branch for the money, so much the better for themselves, and the greater the credit that is due to their management. I need hardly say that fire-insurance is as much a *trade*, as steam-engine making or ship-building, in fact "Aquarius" has himself admitted this point.*

"Aquarius" has made a garbled extract from my letter on the relations of the Insurance Companies and the public to each other, published at page 157 of your 26th volume. To those who are not sick and tired of this controversy† I would merely suggest the careful perusal of the whole of that communication, as it furnishes the best answer that could possibly be given to the misrepresentations of "Aquarius."

With his usual felicity at perverting the meaning of what he reads, "Aquarius" endeavours to insinuate that I have represented *anonymous correspondence* to be considered a *disgrace*.

That I ever held or published any such opinion I deny. I well know many persons always write anonymously, who never penned an article in their lives that would not redound to their credit; and of all the cases in which anonymous correspondence is justifiable, none are more strikingly so, than those which are in reply to anonymous communications.

When an individual under the ambush of a fictitious signature puts forth statements to which he could not sign his name without at once exposing the grounds of his hostility and the unworthiness of his motives—when under this paltry screen he upholds views and opinions that he *dare not* manfully avow—then is *his* practice that of a coward, and *his* anonymous communications a *disgrace!*

I remain, Sir,
Yours respectfully,
WM. BADDELEY.

London, May 23, 1839.

* Vol. xxvi, page 264.

† *We fear that too many of our readers are so, to permit us to sanction its proceeding any further.* ED. M. M.

MR. PARKIN'S PATENT WOODEN ROADS.

Sir,—Having read in your valuable Magazine, No. 819, dated the 20th April, 1839, a letter of Mr. John Rivington, Jun., on "Anti-noise contrivances, &c. for railroads and public carriages," in which he recommends wooden tire attached to cast iron for wheels of railway carriages, I beg to make known through the same medium, that for this and other objects, I took out a patent, which passed the Great Seal on the 9th of April, having the following title—"Improvements in Railroad and other Carriages, in wheels for such carriages, and in roads and ways on which they are to travel;"—and I beg to add, that under this patent I am going to lay down immediately some wood-paving at the Marsh-gate, Lambeth, in which an uniform surface must infallibly be preserved, as the blocks will be united together by means of a tongue or key, fitted into longitudinal notches or grooves on each side of the blocks. I have other modes of uniting the blocks, so as to prevent one sinking beneath another, one of which modes is that of locking the blocks one into another, by their

being cut somewhat in the shape of a V, agreeably to the plan which I patented in 1825 for uniting stone blocks for tram ways.

I am, Sir,

Your most obedient servant,

THOMAS PARKIN.

No. 25, Moorgate-street,
May 15th, 1839.

P.S. I should also have mentioned that my patent includes wooden rails, with the grain vertical, or nearly so, as may be found best.

THE NEW EDITION OF TREDGOLD ON THE STEAM-ENGINE.*

A new edition of the late Mr. Tredgold's "Treatise on the Steam-engine" has been for some time so imperiously required, that when it was announced that a gentleman of high scientific attainments had been engaged to superintend a fresh issue of the work, correcting it where necessary by the aid of the new lights which have been thrown upon the subject since the period at which the book was originally written, and adding all the new facts which have accumulated on all hands within the last few years, it was pretty generally anticipated that the great desideratum—a *standard* history of the steam-engine—was at length about to be presented to the world. We are afraid that the result will be a general disappointment. Mr. Woolhouse, the editor, may be said rather to have got together a quantity of the materials necessary for his task, than to have built them up into a fitting and substantial edifice. Nor is this all: he has made comparatively few additions to the general subject, but confined his attention almost entirely to one particular branch of it—certainly a most important one—that of steam navigation. The new edition is, in fact, as the title-page has it, "enlarged," rather than improved. The main body of the work is left pretty nearly in the same state in which it was left by Tredgold, and the additions, contributed as they are by a number of different hands, and relating, as they do, to disconnected, and, in a manner of speaking, merely *local* subjects, compensate in a very small degree (if any) for the lack of editorial superintendence in those parts where it was most required. The original text, if on no other ground than the number of years which have elapsed since it was written, and the consequent number of new facts, and corrections of old pseudo-facts which ought to be now interwoven with it, required a very careful and laborious revision; and this revision it has certainly not received, to any thing like the extent called for by the exigencies of the case: while the parts now first published might quite as appropriately have been given to the world in the shape of a distinct publication, as in that of a supplement to the labours of Tredgold.

It is true that many of these added essays have considerable merit and interest in themselves. Mr. Dinnen's, on the "Nature and Management of Marine Boilers," has, of course, all the value which the writer's long course of practical experience can impart to it; and Lieutenant Baldock's two contributions, the "Form of a Steam Journal," and "Memoir of the *Medea*," are full of information, especially the latter, which affords most valuable *data* for determining the proper duty of marine steam machinery. It may be recollected that it was principally from his *deep study* of the performances of this vessel that Dr. Lardner professed to draw his cogent and unanswerable arguments against the practicability of steaming across the Atlantic; and it affords a curious sample of the different impressions produced by the same facts on the theorizing lecturer in the closet, and the practical seaman upon deck, to find that the lieutenant drew the conclusion that the voyage in question was quite within reach, from the performances of the very same steamer which furnished the *Doctor* with his irrefragable proofs of the impossibility of what is now an every-day occurrence! Nothing can be plainer or more satisfactory than the reasoning with which Lieutenant B. makes out his case, taking as his ground-work the actual distances

* The Steam-engine, its Invention and Progressive Improvement, an Investigation of its Principles, and its Application to Navigation, Manufactures, and Railways. By Thomas Tredgold, C.E., &c. A new edition, enlarged by the Contributions of eminent Scientific Men, and extended to the Science of Steam Naval Architecture. Revised and edited by W. S. B. *Woolhouse, F.R.A.S., &c.* In *two vols., with 125 Engravings and numerous Wood Cuts. London, 1838.* John Weale. 4to. *(Vol. 1. pp. 760; vol. 2. all plates.)*

achieved by the *Medea* in the Mediterranean:—

"Rate of steaming, with 320 tons of coal and war equipment on board, in a calm, 8¾ knots per hour, when lightened by the expenditure of one-third the fuel, 9¼ knots per hour, of two-thirds, 10 knots per hour, she will therefore go at 8½ knots an hour about ..... 1190 (knots)
at 9 knots an hour..... 1258
at 10 knots an hour .. 1360

Thus accomplishing the distance of..... 3808 knots or geographical miles.

"Each rate being attained by a gradual progression, as the ship lightens from the expenditure of coals, and as the latter part of the distance may be at a speed even above ten knots, some addition should be made to the gross amount above stated; it must, however, be observed, that the experiments from which the foregoing data are taken, were all made in calm weather, but as the consumption of fuel is, by a judicious arrangement of the dampers, and by slackening the fires, considerably lessened as the speed is diminished from the violence of the wind or sea, we may safely state that the *Medea* is competent to undertake any voyage of at least 3000 miles, except a westerly passage across the the North Atlantic in the winter season; at which period of the year the ocean between England and America is swept with scarce an intermission by violent westerly gales, creating waves which, even supposing the temporary cessation of the wind, must oppose an effectual barrier to the favourable operations of any steamer. We by no means presume to state that the voyage cannot be made, or these difficulties safely overcome, by a powerful vessel with a large supply of fuel; but her progress at times must be very slow; and though no doubt in such a case she might cross the Atlantic in much less time than a sailing ship under similar circumstances, it would be at a speed far below the usual rate of steaming voyages.

"It is proper to state, with reference to the coal carried by the *Medea*, that the weight of the armament and war *material* is quite equal to 50 tons, and consequently, that if disarmed, she could carry fuel without being further immersed in the water, or her progress thereby impeded, sufficient for a voyage, the extent of which may be at least 500 miles more than the distance before stated: she might therefore be sent to the West Indies with despatches, or even troops at a few hours notice, almost with a certainty of reaching Barbadoes, or any other of the Windward Islands, in nineteen, or at most twenty days, under the average circumstances of weather usually experienced in that voyage."—p. 85.

It may be recollected that Dr. Lardner, on the strength of the data he professed to have derived chiefly from the logs of this very *Medea*, sought to establish the distance of 2080 miles as what he termed a "steam limit," which it was impossible to overpass without a halt for fresh fuel. Lieutenant Baldock shows that at the same time she was capable of going 3808 miles, or hard upon double the worthy Doctor's utmost verge! Nor is the Doctor treated with much more ceremony in the extract we are about to quote, which forms part of a very sensible and (which is extremely rare) unexaggerated account of the "Progress of Steam Navigation in the United States," from the pen of Professor Renwick, of Columbia College:—

"The arrival of the *Great Western* in New York was preceded by that of the *Sirius*, although only by a few hours. The competition for the honour of successfully accomplishing this voyage, between the respective owners and commanders of these vessels, involves less of reputation than is generally believed. It is nearly 20 years since the *Savannah*, a steam boat built and equipped in the port of New York, made a voyage to Europe and returned. If then her honours are to be awarded it is to the parties concerned in the *Great Western* that they are due; for the mere practicability of the enterprise is not the point on which well informed persons have ever hesitated; but the doubt has been whether it can be made certain within given limits of time, and whether these limits will be less than the average passage of packet ships.

This point, which the arrival of the *Sirius* would have left in doubt, is decided by the voyage of the *Great Western*. The question of the relation between the cost of the enterprise and the freight, is still undecided. We do not doubt, however, that this will be such as to yield a profit.

"The *Susannah* proceeded from New York to Liverpool without stopping at any intermediate port, from Liverpool to St. Petersburgh, touching at Copenhagen. In returning thence this vessel entered the port of Drendal, in Norway, and then crossed the Atlantic a second time to New York, without making any intermediate port. Steam however, was not used during the whole voyage, but the use of the engine was intermitted whenever the wind was such as to enable

the vessel to lay her course without deviation. No record appears to remain of the time in which steam alone was used, but the two passages across the Atlantic were each made in about twenty-five days."—p. 112.

The remainder of the Professor's paper is of an equally interesting character with the above, and his account of the flying steamers of the Hudson is particularly full and satisfactory. That these "clippers" are as fast as any in the world may be pretty safely acknowledged; and if half what has been said of their performances in the puffing paragraphs of our Transatlantic friends of the broad-sheet were true, competition with them, in any thing but a veritable phantom-ship, might well be out of the question. Professor Renwick, however, is more sober and incalculably more precise in *his* statements, and although he seems to be of opinion that the feats of speed he records are unapproachable on any but the waters of the new world, the facts he thinks it necessary to support by his strongest asseverations are such as to be by no means incredible by the constant passengers on board our own crack Gravesenders. The Professor very solemnly assures us that he once himself steamed along the Hudson, with wind and tide in favour, at the rate of *eighteen* miles an hour. If this were all, the *Ruby* and some more of the fast-goers of the Thames might run against Brother Jonathan's best, and give him a mile or two to boot! Yet, strangely enough, the immense speed of the American boats has been so incessantly boasted of, that their superiority is tacitly admitted as an established fact by many of the most intelligent of our own engineers! It is, of course, taken for granted by the Professor throughout the whole course of his essay.

The principal article among the additional matter which does not immediately relate to steam navigation is a long and most elaborate description of Stephenson's locomotive engine, illustrated with numerous engravings. The value of this paper cannot be doubted, whatever may be thought of the appropriateness of its situation. The chief mathematical articles consist of papers on "The Motion of Steam Vessels and Principle of Paddle-wheels," by Mr. P. W. Barlow; on "the Theory of the motion of Paddle-wheels," *by M. Mornay;* and a series of "Practical Rules for Calculating the Steam Engine," furnished by Mr. Hann, in the engineering department, of King's College. There is no attempt at connecting any of these together: the new articles, which amount altogether to half as much as Tredgold's original text, stand by themselves alone, without any particular relation to each other, or the work to which they are attached.

The plates are nearly in the same predicament; they are of value as forming illustrations of particular points in steam naval architecture and machinery, but rather out of place as embellishments to a general treatise, composed as they are, in a great measure, of minute plans of particular vessels, in some few cases, perhaps, "of no use to any but the owner,' and in *not* a few, of insufficient importance to hold so prominent a station. In point of execution, however, the whole of the engravings are unexceptionable, and the book altogether, so far as the mechanical departments are in question, is highly creditable to the parties concerned.

We have thought it unnecessary to pass remarks on, or make extracts from, a book so well-known as Tredgold's Original Treatise, but a portion of the preface is so singularly applicable to events which have occurred since it was first written (1827) and the observations it contains are so well worthy of consideration, that we shall conclude by quoting it. Bearing in mind that the decline of science faction dates its existence from some years later than that which his work appeared, Mr. Tredgold would seem to have been actuated by almost a prophetic spirit in the pungent sentences which follow:—

"It has been too common of late for mathematicians to complain of want of patronage, and to censure official authorities for not encouraging science, forgetting that research will always be estimated by its immediate utility; and while they continue to confine their attention to abstract knowledge, while they do not devote a greater part of their time to its application to the wants and welfare of society, they must be contented with a small share of those advantages which result from combining with practical skill the power afforded by abstract reasoning. They should recollect that a Watt could have earned no fame, in an age or in a country where the value of mechan-

ical power was unknown. In following the application of science to art, I have not, however, I hope, been unsuccessful in adding also to the stores of pure science; and so far from being insensible to the value of abstract research, I wish it to be pursued with redoubled vigour by those who have spirit to break through the prejudices of existing systems, and study from nature: but it should be cultivated with a desire to promote the great end of human research, that is the improvement of the condition of man; otherwise the fantasies of the Greek philosophers might with equal force claim the student's regard."

MANUFACTURE OF PAPER HANGINGS.

[*Abridged from a paper by Mr. Crace, read before the Institute of British Architects.*]

Flock papers, or rather hangings, were introduced into England in the time of Charles I. A person named John Lanyer, obtained a patent for the invention in 1634. An article in an old French dictionary of commerce, proves that the coloured paper-hangings were made at any rate in that country in the seventeenth century, and referring to statutes relating to them even of the date 1586.

There were formerly three modes in which paper hangings were manufactured. First, by printing the outline with blocks and then colouring by hand.

Secondly, stenciling, which is performed by cutting out either in paper, leather, or other materials, the pattern intended to be represented, and then, placing this on the prepared ground, brushing it over with the proper colour. This mode gives an imperfect outline, and is now discontinued in paper staining, and merely sometimes employed by plasterers to ornament coloured walls.

The third is the mode now almost universally adopted in this manufacture, whereby every colour is applied by a separate block, according to the tints and shadows intended to be represented.

Lanyer's patent did not even mention paper among the substances on which flock could be applied, as it was at that period of too rotten and bad a quality to bear the weight of the woollen material. But paper has now been brought to so high a degree of perfection that it is the only substance employed, and has thus assisted greatly the operations of the paper stainer. Till within the last twelve years the pieces of paper hangings were formed of sheets, each about *three quarters of a yard long*, pasted together till the proper length of twelve yards was completed. This method was attended with many inconveniences, the joints rising, or being imperfect, and generally showing, all which evils are now remedied by the pieces consisting of one perfect length of paper, without any joints whatever; the width, too, can be enlarged to two or three times the ordinary size, as is now repeatedly done in France, as these examples will show, though we have not as yet adopted this plan.

The modern coloured papers are almost all worked in distemper, or colour mixed with size to bind it, instead of with oil or varnish, which was more employed formerly, and is now, in fact, used in the manufacture of the washable paper hangings; the effect of them, however, is not nearly so clear and brilliant as in those worked by the former method.

Distemper, or body colour, is generally thus prepared:—Whiting finely powdered and soaked in water is first well mixed, as stiffly as it can be worked, and then stained with the proper colours, well ground in water; when the desired tint is produced, double size melted with about an equal proportion of water is added, till the colour is about the consistency of cream, and when chilled it is fit for use.

Commencing with the more simple papers, the first process is that of laying the grounds; to do this, the paper being placed on a bench about twelve feet long, the workman with two large brushes filled with colour, one in each hand, passes them over the paper with a circular motion, and as each piece is completed it is supported and carried by the attending boy on a stick, and placed on the rack to dry.

An ingenious machine has lately been invented, in which by three brushes acting, one with the other, the grounds are completely and evenly coloured and in a much more expeditious manner than by hand.

The grounds being prepared, we will proceed with the printing, which is performed by means of blocks. They are carved most generally in pear tree, mounted on white deal; the design being first traced on the wood, the engraver or cutter, taking care to follow the exact outline, cuts perpendicularly to the depth of one-eighth of an inch, and then slopes off till he gets to the deal. I should add, that where very sharp lines or dots are required, metal is inserted in the block.

The colour with which the printing is to be performed, being mixed to the proper tint, is spread with a brush on what is called the sieve—a wooden frame covered with a blanket—the block is pressed on this and

then applied to the paper, on which it leaves the impression of the design. There is a method of printing by a patent machine, invented by Messrs. Archer and Taverner, whereby, by placing the blocks on the sieve and then on the paper is performed with great exactness, with the labour of merely turning a lever handle, which is done by a boy. It was found, however, too cumbrous to move.

In the first case the pattern is given to the paper by a single block, but as in the second, where there are two shades of colour, two blocks are necessary. Now, in order that the second block may be placed exactly in its proper situation, you perceive that there are pin marks in each block corresponding with each other, and on the marks printed by the first block the pins of the second block are placed, and the pattern is thus completed with the required correctness.

In another case a very delicate and shaded effect is given by a single impression, which is produced by what is called pin-work on a cylinder.

The pattern is formed by small brass pins of various sizes, fixed on a wooden cylinder at different spaces, according to the depth of shade required. This, fixed in a machine, is made to revolve so as to be supplied with colour from a blanket, and at the same time print the piece of paper very speedily without any interruption. This process, only lately applied to paper staining, is derived from one much resembling it, in use in calico printing, only that the latter so far differs that the colour is contained inside the cylinder, and the pattern represented by holes pierced in it instead of pins fixed on it.

In other cases the pattern is worked on what is called a blended ground; this is also a modern invention, originating, I believe, in France. The blending is performed by a machine purposely constructed. A metal trough, the length of the breadth of paper, containing about twenty divisions, has in those divisions various tints of colour, according to the blending required; a long narrow brush is then dipped into the trough, and being filled with colour, applies it to a roller, from which it is collected by a large cylindrical brush the same length, which is made to revolve, and when it is properly supplied with colour it is then brought to bear upon the paper, on which it thus places the grounds, though in order to make it sufficiently perfect it is necessary to be done twice.

A common marble paper is printed by blocks in the ordinary way, and afterwards varnished with turpentine varnish, by which process it is enabled to bear washing, water not injuring it.

There is an improved imitation marble paper, made by Archer and Taverner, in which, if assisted by a few veins laid in by hand, the effect is certainly much superior to the last. The operation is considered secret, but it is easy to be perceived that the mode of making it nearly resembles that employed by the makers of the bookbinders' marble paper in which thickly gummed colours are made to float on the surface of water, and being stirred in various forms, are thus absorbed by the paper when applied to them.

In an imitation of wainscot the ground is combed as in the usual painted imitations of this wood, and the veins are afterwards printed.

The satin ground paper is a great improvement on the common grounds, and enables the manufacturer to produce imitations of silks and satins, which have a very elegant appearance. I have made every exertion to discover the date of the introduction of this improvement, but unfortunately without success. The oldest in the trade have never heard of it as a recent invention.

The satin ground is laid with satin white, a compound formed of lime and alum, and it can be coloured to almost any tint. After being laid like the common grounds, powdered French chalk is rubbed on it with a hard brush till the gloss is produced, and it is then glazed with clear size.

A process has been invented in England within the last five or six years which adds materially to the beauty of the satin grounds; this is embossing, where imitations of watered and figured silks, stamped leather, &c. are produced. The embossing is performed by the paper being passed between two rollers, on one of which is the engraved pattern, and which also being slightly heated thus stamps the required design on the paper.

A kind of paper hanging in which the English designers seem to excel is called chintz, and has been introduced in imitation of the printed cottons and muslins, which seem to have been copied from Indian designs. There are in general several colours in these patterns, requiring many blocks and much delicacy in execution, though the number of blocks is sometimes much lessened by printing wash colours; such as yellow on blue making green, yellow on red orange, and lake on blue purple.

A manufacture of Archer and Taverner is one of the most creditable attempts in modern English paper staining. It is an imitation of Chinese paper, and is composed of

eighteen sets of blocks, each set containing four, altogether seventy-two blocks. It will be perceived that the flowers in that paper are shaded, which is effected by a process resembling that employed in blending the grounds. The long narrow brush is dipped in the trough containing the proper tints of colour, and spreads these on the sieve. The block with the flowers engraved on it is then applied to the sieve thus arranged in shades, and afterwards prints the flowers in the tints, which are blended. This is a modern invention, first practised about five years ago by the Messrs. Harwood, the oldest firm at present in the trade.

Another important mechanical contrivance was invented about twenty years ago, whereby striped papers are executed with great exactness and clearness by a machine in lieu of blocks, which owing to the working always made an imperfect line. In this machine a copper trough, in which narrow slits of the required breadth are cut at the bottom, being filled with thin colour, is applied to the paper, which is made to pass over a revolving cylinder, and draws the colours through the slits in the trough, by which the stripes are formed.

The ground of another specimen is crimson, and is laid with a staining colour instead of distemper. This colour, prepared principally from cochineal, is applied to the paper in the form of a wash, and is generally laid six times to produce a fine stain, the first coat being done with gamboge. In working the pattern it is printed before the staining is done, and thus acquires a much greater richness of colour.

The next example is a flock paper, a kind of hanging originally introduced as an imitation, of the wove tapestries and velvet damasks. It has been employed in England more than 200 years, but about sixty years ago the art was almost lost, and only revived forty years since. The mode of working is very simple, although much mystery used to be observed respecting it. Flock is composed of the cuttings of white or bleached woollen cloth cut up in a mill to the necessary degree of fineness, and then dyed to various tints of colours. It is applied to the paper in the following manner:—The ground being prepared, the design is first printed with the block in size, in order that the oil may bear out when applied; when this is dry it is then printed with a composition of boiled oil and japan gold size, and while this is still wet the paper is laid on the drum (a kind of box about five feet by three feet, with the sides of wood and the bottom of *ticking*); the flock is then sprinkled over *the paper, and the* workman, with a cane, *beats the under side of* the drum, which causes the flock to spread evenly over every part of the pattern, to which it is fixed by means of the japan composition. Sometimes one flock is applied over another, this is easily accomplished by merely repeating the process after the first flock is perfectly dry.

In the next specimen a beautiful imitation of tapestry is produced by the introduction of flocks of various colours, and is done exactly as in the former examples, each flock being separately printed after the former ones are properly hardened and set.

I now take up the last of the three kinds of paper hangings, wherein metals are employed to produce imitations of gilt leather, rich brocades, or lightly etched ornaments. It is to these papers that our manufacturers seem now to devote their chief attention, and they work them with great beauty and richness, at a comparatively moderate price. Gilt leather was employed in England even in the time of Henry VIII., and the English were afterwards famed for its manufacture. I have every reason to suppose that gold and silver and metal leaf were introduced in the early paper hangings as an imitation of the more expensive leather hanging, although I have not been able to discover the exact date of their first application. In addition to these there is another material of much more recent introduction, called bronze or imitation gold dust, which is now very extensively employed. This bronze is the invention of an artist at Nuremberg, named John Halitsch, who was born in 1595, and died in 1670, and his descendants have continued the manufacture to the present time. It is prepared by sifting the filings of different metals, washing them in a strong lye, and then placing them on a plate of iron or copper over a strong fire, where they are continually stirred till the colour is altered. Those of tin acquire by this process shades of gold colour, copper, red, and flame colours; iron and steel, blue and violet; and tin and bismuth, shades of a bluish white. The dust tinged in this manner is then put through a flatting mill.

A bronze paper is thus worked:—The design (as with flock) is first stamped with size, and afterwards with boiled oil and japan gold size; this preparation is allowed to dry, but while it still retains a tack the bronze is brushed over with a hare's foot or soft brush; it thus adheres to the gold size, and the paper is in the state exhibited.

In another paper a much more splendid effect is produced by a metal, in imitation of gold leaf. A gold size, resembling that for bronze, is first applied, and while it has a tack the metal leaf is laid on. This metal, sometimes called mossic gold or Dutch

metal, is prepared in Germany, and is an amalgam of tin and copper. The effect of it on the paper is very much improved by embossing.

When coloured flocks are united with the metal pattern very splendid hangings are produced. The metal, too, is sometimes shaded, which is done by stains formed from berries, of which various kinds are used; and metal is also applied on a bronze ground, but the process is simply that already described. I need not add that in all cases where the metal is employed gold leaf may be substituted, but it is rarely used on account of the great increase in price. I have not described the washable paper hangings, or Delarue's patent paper hangings, because they are similar to those of which I have already spoken, with the exception that they are worked with japan gold size and turpentine instead of distemper, and the latter by being embossed in horizontal lines, forms, by embossing alone, a pattern similar to that produced by printing.

I have made particular inquiries as to how the manufacture of paper hangings is conducted in France. I have visited the factories, and have the pleasure of being acquainted with the most eminent manufacturer at Paris, Monsieur Dauptain, and from all I can learn I do not find that the French employ other means than those known to us. In those papers of such large dimensions they have double sets of blocks, and in the decorative papers the mode of working is the same as our own; look, in fact, at what was done by our English manufacturers, Echardt and Sherringham, fifty years since; their works equal those of the French at the present day.

MODES OF MAKING VARIOUS VARNISHES.

Copal varnishes for fine paintings, &c.—Fuse 8lbs. of the very cleanest pale African gum copal, and, when completely run fluid, pour in two gallons of hot oil, old measure; let it boil until it will string very strong; and in about fifteen minutes, or while it is yet very hot, pour in three gallons of turpentine, old measure, and got from the top of a cistern. Perhaps during the mixing, a considerable quantity of the turpentine will escape; but the varnish will be so much the brighter, transparent, and fluid; and will work freer, dry more quickly, and be very solid and durable when dry. After the varnish has been strained, if it is found too thick, before it is quite cold, heat as much turpentine, and mix with it, as will bring it to a proper consistence.

Cabinet varnish.—Fuse 7lbs. of very fine African gum copal, and *pour in half a gallon* of pale clarified oil; in three or four minutes after, if it feel stringy, take it out of doors, or into another building where there is no fire, and mix with it three gallons of turpentine; afterwards strain it, and put it aside for use. This, if properly boiled, will dry in ten minutes; but if too strongly boiled, will not mix at all with the turpentine; and *sometimes*, when boiled with the turpentine, will mix, and yet refuse to incorporate with any other varnish less boiled than itself: therefore it requires a nicety which is only to be learned from practice. This varnish is chiefly intended for the use of japanners, cabinet-painters, coach-painters, &c.

Best body copal varnish for coach-makers, &c.—This is intended for the body parts of coaches and other similar vehicles, intended for polishing.

Fuse 8lbs. of fine African gum copal; and two gallons of clarified oil (old measure); boil it very slowly for four or five hours, until quite stringy; mix with three gallons and a half of turpentine; strain off, and pour it into a cistern. As they are too slow in drying, coach-makers, painters, and varnish makers, have introduced to two pots of the preceding varnish, one made as follows:—

8 lbs. of fine pale gum animé;
2 gallons of clarified oil;
3½ gallons of turpentine.
To be boiled four hours.

Quick drying body copal varnish for coaches, &c.

(1.) 8 lbs. of the best African copal;
2 gallons of clarified oil;
½ lb. of dried sugar of lead;
3½ gallons of turpentine;
Boiled till stringy, and mixed and strained.

(2.) 8 lbs. of fine gum animé;
2 gallons of clarified oil;
½ lb. of white copperas;
3½ gallons of turpentine.
Boiled as before.

To be mixed and strained while hot into the other pot. These two pots mixed together will dry in six hours in winter, and in four in summer; it is very useful for varnishing old work on dark colours, &c.

Best pale carriage varnish.

(1.) 8 lbs. 2d sorted African copal;
2½ gallons of clarified oil.
Boiled till very stringy.
¼ lb. of dried copperas;
¼ lb. of litharge;
5½ gallons of turpentine.
Strained, &c.

(1.) 8 lbs. of 2d sorted gum animé;
2½ gallons of clarified oil;
¼ lb. of dried sugar of lead;

¼ lb. of litharge;
5½ gallons of turpentine.
Mix this to the first while hot.

This varnish will dry hard, if well boiled, in four hours in summer, and in six in winter. As the name denotes, it is intended for the varnishing of the wheels, springs, and carriage parts of coaches, chaises, &c.; also, it is that description of varnish which is generally sold to and used by house-painters, decorators, &c., as from its drying quality and strong gloss, it suits their general purposes well.

Second carriage varnish.

8 lbs. of 2d sorted gum animé;
2¾ gallons of fine clarified oil;
5½ gallons of turpentine;
¼ lb. of litharge;
¼ lb. of dried sugar of lead;
¼ lb. of dried copperas.
Boiled and mixed as before.

Wainscot varnish.

8 lbs. of 2d sorted gum animé;
3 gallons of clarified oil;
¼ lb. of litharge;
¼ lb. of dried sugar of lead;
5½ gallons of turpentine.
To be well boiled until it strings very strong, and then mixed and strained.

Mahogany varnish is made either with the same proportions, with a little darker gum; otherwise it is wainscot varnish, with a small portion of gold size.

Black japan, is made by putting into the set-pot 48 pounds of Naples, or any other of the foreign asphaltums (except the Egyptian). As soon as it is melted, pour in 10 gallons of raw linseed oil; keep a moderate fire, and fuse 8 pounds of dark gum animé in the gum pot; mix it with two gallons of hot oil, and pour it into the set-pot. Afterwards fuse 10 pounds of dark or sea amber in the 10 gallon iron pot; keep stirring it while fusing; and whenever it appears to be overheated, and rising too high in the pot, lift it from the fire for a few minutes. When it appears completely fused, mix in 2 gallons of hot oil, and pour the mixture into the set-pot; continue the boiling for 3 hours longer, and during that time introduce the same quantity of driers as before directed: draw out the fire, and let it remain until morning; then boil it until it rolls hard, as before directed: leave it to cool, and afterwards mix with turpentine.

Pale amber varnish.—Fuse 6 pounds of fine picked very pale transparent amber in the gum-pot, and pour in 2 gallons of hot clarified oil. Boil it until it strings very strong. Mix with 4 gallons of turpentine. This will be as fine as body copal, will work very free, and flow well upon any work it is applied to: it becomes very hard, and is the most durable of all varnishes; it is very excellent to mix in copal varnishes, to give them a hard and durable quality. Observe; amber varnish will always require a long time before it is ready for polishing.

Best Brunswick black.—In an iron pot, over a slow fire, boil 45 pounds of foreign asphaltum for at least 6 hours; and during the same time boil in another iron pot 6 gallons of oil which has been previously boiled. During the boiling of the 6 gallons, introduce 6 pounds of litharge gradually, and boil until it feels stringy between the fingers; then ladle or pour it into the pot containing the boiling asphaltum. Let the mixture boil until, upon trial, it will roll into hard pills; then let it cool, and mix it with 25 gallons of turpentine, or until it is of a proper consistence.

Iron-work black.—Put 48 pounds of foreign asphaltum into an iron pot, and boil for 4 hours. During the first 2 hours, introduce 7 pounds of red lead, 7 pounds of litharge, 3 pounds of dried copperas, and 10 gallons of boiled oil; add 1 eight-pound run of dark gum, with 2 gallons of hot oil. After pouring the oil and gum, continue the boiling 2 hours, or until it will roll into hard pills like japan. When cool, thin it off with 30 gallons of turpentine, or until it is of a proper consistence. This varnish is intended for blacking the iron-work of coaches and other carriages, &c.

A cheap Brunswick black.—Put 28 pounds of common black pitch, and 28 pounds of common asphaltum made from gas tar, into an iron pot; boil both for 8 or 10 hours, which will evaporate the gas and moisture; let it stand all night, and early next morning, as soon as it boils, put in 8 gallons of boiled oil; then introduce, gradually, 10 pounds of red lead, and 10 pounds of litharge, and boil for 3 hours, or until it will roll very hard. When ready for mixing, introduce 20 gallons of turpentine, or more, until of a proper consistence. This is intended for engineers, founders, ironmongers, &c.! it will dry in half an hour, or less, if properly boiled.

Fine mastic, or picture varnish.—Put 5 pounds of fine picked gum mastic into a new 4-gallon tin bottle; get ready 2 pounds of glass, bruised as small as barley; wash it several times; afterwards dry it perfectly, and put it into the bottle with 2 gallons of turpentine that has settled some time; put a piece of soft leather under the bung; lay the tin on a sack upon the counter, table, or any thing that stands solid; begin to agitate the tin, smartly rolling it backward and forward, causing the gum, glass, and turpentine, to work as if in a barrel-churn for

at least 4 hours, when the varnish may be emptied out into anything sufficiently clean, and large enough to hold it. If the gum is not all dissolved, return the whole into the bottle, and agitate as before, until all the gum is dissolved; then strain it through fine thin muslin into a clean tin bottle: leave it uncorked, so that the air can get in, but no dust; let it stand for 9 months, at least, before it is used; for the longer it is kept, the tougher it will be, and less liable to chill or bloom. To prevent mastic varnish from chilling, boil 1 quart of river sand with 2 ounces of pearl ashes; afterwards wash the sand three or four times with hot water, straining it each time; put the sand on a soup-plate to dry, in an oven; and when it is of a good heat, pour half a pint of hot sand into each gallon of varnish, and shake it well for 5 minutes; it will soon settle, and carry down the moisture of the gum and turpentine, which is the general cause of mastic varnish chilling on paintings.

Common mastic varnish.—Put as much gum mastic, unpicked, into the gum-pot as may be required, and to every 2¾ pounds of gum pour in 1 gallon of cold turpentine; set the pot over a very moderate fire, and stir it with the stirrer; be careful, when the steam of the turpentine rises near the mouth of the pot, to cover it with the carpet, and carry it out of doors, as the vapour is very apt to catch fire. A few minutes' low heat will perfectly dissolve 8 pounds of gum, which will, with 4 gallons of turpentine, produce, when strained, 4½ gallons of varnish; to which add, while yet hot, 5 pints of pale turpentine varnish, which improves the body and hardness of the mastic varnish.

Crystal varnish, may be made either in the varnish-house, drawing-room, or parlour. Procure a bottle of Canada balsam, which can be had at any druggist's; draw out the cork, and set the bottle of balsam at a little distance from the fire, turning it round several times, until the heat has thinned it; then have something that will hold as much as double the quantity of balsam; carry the balsam from the fire, and, while fluid, mix it with the same quantity of good turpentine, and shake them together until they are well incorporated: in a few days the varnish is fit for use, particularly if it is poured into a half-gallon glass or stone bottle, and kept in a gentle warmth. This varnish is used for maps, prints, charts, drawings, paper ornaments, &c.; and when made upon a larger scale, requires only warming the balsam to mix with the turpentine.

White hard spirit-of-wine varnish.—Put 5 pounds of gum sandarac into a 4-gallon tin bottle, with 2 gallons *of spirits of wine, 60* over proof, and agitate it until dissolved, exactly as directed for the best mastic varnish, recollecting, if washed glass is used, that it is convenient to dip the bottle containing the gum and spirits into a copperful of hot water every 10 minutes—the bottle to be immersed only 2 minutes at a time—which will greatly assist the dissolving of the gum; but above all, be careful to keep a firm hold over the cork of the bottle, otherwise the rarefaction will drive the cork out with the force of a shot, and perhaps set fire to the place. The bottle, every time it is heated, ought to be carried away from the fire; the cork should be eased a little, to allow the rarefied air to escape; then driven tight, and the agitation continued in this manner until all the gum is properly dissolved, which is easily known by having an empty tin can to pour the varnish into, until near the last, which is to be poured into a gallon measure. If the gum is not all dissolved, return the whole into the 4-gallon tin, and continue the agitation until it is ready to be strained, when every thing ought to be quite ready, and perfectly clean and dry, as oily tins, funnels, strainers, or any thing damp, or even cold weather, will chill and spoil the varnish. After it is strained off, put into the varnish 1 quart of very pale turpentine varnish, and shake and mix the two well together. Spirit varnishes should be kept well corked; they are fit to use the day after being made.

Brown hard spirit varnish—is made by putting into a bottle 3 pounds of gum sandarac, with 2 pounds of shellac, and 2 gallons of spirits of wine, 60 over proof; proceeding exactly as before directed for the white hard varnish, and agitating it when cold, which requires about 4 hours' time, without any danger of fire; whereas, making any spirit varnish by heat is always attended with danger. No spirit varnish ought to be made either near a fire or by candle light. When this brown hard is strained, add 1 quart of turpentine varnish, and shake and mix it well: next day it is fit for use.

The *Chinese varnish*, comes from a tree, which grows in Cochin-China, China, and Siam. It forms the best of all varnishes.

Gold lacker.—Put into a clean 4-gallon tin, 1 pound of ground turmeric, 1½ ounces of powdered gamboge, 3½ pounds of powdered gum sandarac, ¾ of a pound of shellac, and 2 gallons of spirits of wine. After being agitated, dissolved, and strained, add 1 pint of turpentine varnish, well mixed.

Red spirit lacker.

2 gallons of spirits of wine;
1 pound of dragon's blood;
3 pounds of Spanish annotto;

3¼ pounds of gum sandarac;
2 pints of turpentine.
Made exactly as the yellow gold lacker.

Pale brass lacker.

2 gallons of spirits of wine;
3 ounces of Cape aloes, cut small;
1 pound of fine pale shellac;
1 ounce of gamboge, cut small.
No turpentine varnish. Made exactly as before.

But observe, that those who make lackers, frequently want some paler, and some darker, and sometimes inclining more to the particular tint of certain of the component ingredients. Therefore, if a 4-ounce phial of a strong solution of each ingredient be prepared, a lacker of any tint can be produced at any time.—*Dr. Ure's Dictionary.*

MR. JAMES THE ORIGINAL PROJECTOR OF THE RAILWAY SYSTEM.

We extract the following letter from the *Midland Counties' Herald*, in which we are sorry to have to observe, it appeared as an *advertisement*. This putting of a clog to the publication of an apparently well-founded claim, does not tally with the general liberal tone of expression of our local cotemporary. The right of Mr. James to be considered as the projector of the Liverpool and Manchester Railway, the first public railway on which steam power was used, was formally acknowledged, by the Directors of that company granting his widow a sum of £300 as the price of his survey. In saying this, we do not intend to throw the slightest slur upon Mr. Stephenson's merits; he has enough and to spare in being the carrier out of that stupendous system of internal communication which his partner, Mr. James, projected.

Mr. Editor—These are times when justice and liberality are, or are said to be, the leading characteristics of the public voice; the columns of every journal attest it, and worth and genius rarely fail to meet their due tribute of acknowledgment and reward.

In *The Midland Counties' Herald* of the 16th instant, I notice the announcement of a testimonial, principally among the ironmasters of the counties of Stafford and Warwick, to Robert Stephenson, Esq., railway engineer; also, an extract from *The Railway Times*, on which I feel myself called to make a few remarks.

I must first affirm that no person more than myself entertains a higher respect and regard for the above-mentioned gentleman, *both* with reference to his public capacity and as a personal friend of my earlier days; and the nation cannot too warmly appreciate his indefatigable and successful exertions for the increase of the wealth and prosperity of his country.

But the paragraph alluded to is calculated to mislead the public on one important point. Who is it that has been styled the "*Father of Railways?*" Whose inventive and soaring genius *first* brought the great principle of locomotion to bear upon the public mind, and intuitively, as it were, marked out the system to be one of such transcendent power as to become one of the glories of England? The individual in support of whose claim I now come forward, is the late Mr. William James, of Thavies Inn, London, and formerly of Warwick. It was he who *first* projected and surveyed the Central Union Railway, with its intended terminus at Newhall Hill, Birmingham, of which he was lessee: subsequently the Manchester and Liverpool, and many of the principal lines now in existence, some of them at his own expense. It should be known to the public, that Mr. Stephenson, sen., became co-partner with Mr. James, *after* the latter had surveyed the Manchester and Liverpool Railroad, Mr. Robert Stephenson then acting under him, and an agreement was entered into to bring into use locomotive engines, and to divide the country into two parts, all above York and Lancaster to be Mr. Stephenson's province, and all below, Mr. James's. The bill not being obtained for several years, he proceeded with the London, Brighton, and Portsmouth lines, &c., &c., on which he published his observations. In 1816 he was elected Chairman of the Ironmaster's Company, at West Bromwich, and in consideration of his important services to the trade, some substantial testimonial expressive of this sentiment was commenced, but never fulfilled. His labours for the public good were unceasing throughout life; his views for the drainage of Lambeth Marsh, with the projection of Waterloo Bridge, as reported to Government, were afterwards carried into execution. His discovery of the thick coal at West Bromwich led to the proposition of the before-mentioned Central Union Railway to the collieries, which, in conjunction with the Stratford Canal, which he completed, and the river Avon, which he rendered navigable from Tewkesbury, (in both of which he was the principal proprietor,) cannot be enlarged on here. To the railway system the last twenty years of his life were especially devoted, in the furtherance of schemes on which he had numerous and almost insurmountable difficulties to contend with from public prejudices then

existing, as may be seen by his extensive reports and correspondence with noblemen and merchants, which are about to published in a Biographical Memoir, in numbers. His own ample fortune was entirely expended in scientific speculations and national improvements, to the detriment of his family, who are thereby left *without any patrimony whatever*. His bodily frame and the energies of his mind were, at length, exhausted by a long-continued series of cares and disappointments. He now lies numbered with those who have been; and his truly important national services, although acknowledged, have never been recompensed. Will a liberal-minded public thus bury in oblivion the *projector* of the *railway system* in this country? He whose whole life, labours and wealth, were devoted to the cause? The meed of public approbation is sweet to all; even the descendants of departed genius are known to exult for centuries in the glory of *a name*; and I, as one of the sons of the deceased gifted individual, cannot refrain, at this critical juncture, from making this appeal, and claiming a public avowal of services which richly deserve a nation's thanks.

I remain, Sir, your obedient servant,

GEORGE WALTER JAMES.

Handsworth, May 21st, 1839.

ADAMS'S BOW SPRING RAILWAY CARRIAGES.

In our last we stated that Mr. Adams's bow springs had been at work on the London and Birmingham Railway. We have now the pleasure of publishing the following favourable report of their working, extracted from the *Railway Times*, which appeared simultaneously with our description of the invention:—

"A set of Mr. Adams's springs was fitted to one of the Post-office carriages on the London and Birmingham Railway, and on the 17th of April last, a carriage provided with the bow springs started in a train from the station at Euston Grove.

The carriage in question had been at the station for several days before the 17th, and was inspected by many persons, several of whom—those, especially, connected with the railway—expressed an opinion that the springs were ill adapted to railway locomotion, and that the experiment about to be tried would fail—in more ways too, than one.

"It was said that the springs were too light:

"That they would allow of a great deal too much motion:

"That as there were no side guides to keep the axles true, the carriage would run off the rails:

"And that they were not strong enough, and would be broken long before the train reached Birmingham.

"The result of this difference of speculative opinion was, a great anxiety to see how the actual railway experiment came off (as the sporting phrase is). Among those who took seats inside the carriage were the inventor of the spring, and several gentlemen well competent to appreciate the merits of the invention. On the outside were an officer of the Railway Company, and one or two Post-office guards.

"From the moment the train started the superior ease and comfort of the carriage was felt, and severally acknowledged; but the apprehensions of want of strength in the springs—that the carriage would run off the rails—that they would break, and so forth, still remained, in hardly diminished force, in the minds of several individuals of the party.

"At Watford a pan was filled with water, and placed as nearly as possible in the middle of the carriage, on the floor. As the train attained its full speed, the water in the pan became agitated; at first the motion was irregular, but it soon became circular, and the ultimate effect of the centrifugal action was to throw the water over the pan. By the time the carriage had reached half way between Watford and Tring, nearly half the water had been thrown over the edge of the pan, but no more was thrown over during the remainder of the journey to Tring. At Tring the train stopped to set down and take up passengers; and here Mr. Adams and his friends were congratulated by the Company's conductor and the two Post-office guards on the success of the experiment, so far—the guards observing that it was by far the easiest carriage they had ever rode upon. They also gave it as their opinion that the springs were of sufficient strength, and well adapted to keep the carriage upon the rails.

"From Tring, the gentlemen who had witnessed the preceding experiment returned to town in a first-rate-speed carriage, placed at the same relative point in the train as was the carriage in which they travelled to Tring. In the middle of the carriage to which they had thus transferred themselves, and on the floor, they placed the pan before made use of, with the water which remained in it. As the train obtained its full speed, the water became agitated; at first it flew upwards in jerks, but it soon assumed a vibrating motion from side to side, and was forcibly thrown out on each side,—ultimately in quick succession,—thus showing the great

superiority of the apparently slight and elastic "Bow Springs" over the heavy, clumsy, lapped, and all but rigid, springs in common use.

"The equability of the motion of the bow springs was such, that Mr. Adams, while the train was returning at the top of its speed, made a pencil drawing of the invention for a gentleman in the carriage, which it would have been impossible for him to have done in the carriage in which he returned to London.

"One of the passengers by the outward train was Lord Macdonald, who had seated himself in his own well-hung carriage, placed on a truck with the common springs. At some distance beyond Tring his Lordship accepted an invitation to proceed in the carriage with the bow springs, and travelled in it the remainder of the journey, at the end of which he made some very pointed observations on the superior ease and comfort of the carriage compared even with his own.

"The carriage was taken onwards from Birmingham to Liverpool, was returned to Birmingham, and was tried by several of the Directors of the London and Birmingham line, who are well qualified to judge of its merits, and by whom it is highly spoken of.

"The application of the 'bow springs' to every description of railway carriages will be attended with the following very prominent advantages:—

"1. A great diminution of friction.

"2. Diminution also of weight—because the elasticity of the springs, and the equable motion they produce, will admit of considerable reduction in the weight of almost any part of railway vehicles, and also in the fitting up of the locomotive engines.

"3. Security of position on the rails. It has hitherto been deemed necessary to keep the axles in their positions by means of side guides, which, however, prevent them from accommodating themselves to any of the unavoidable inequalities of the railway.

"4. Adaptation to all changes of circumstances. It has been found, by exact measurements, that the axles of many railway carriages are not placed accurately parallel, and cannot run true on the same line, the consequences of which are, increased friction—increased wear and tear of the rails, the wheels, and carriages—great additional weight in every part of the carriages to enable them to withstand the violent oscillations and concussions which even a small deviation (at high velocities) from true paralellism in the axles must occasion, while the power given by the bow springs to each wheel to accommodate itself to every ordinary inequality and impediment, is a remedy for all, or nearly all, of the evils to which reference has been made.

"Looking at the invention as a whole, it is important to observe that it is one which in no respect depends upon fashion or opinion. It is of so simple and practical a character, that a very brief experience must suffice to settle, beyond all dispute and for ever, the question of its utility; and should the result be as favourable to the superiority of the bow spring as we confidently anticipate, then will railway travelling become nearly all that we can ever hope to see realized in point of luxurious ease and equality of motion."

M. GAUDIN'S ROCK SALT THREAD.

M. Gaudin, one of the employés of the Observatory of Paris, has just submitted to the Academy of Sciences a process for converting *Rock Salt* into *ductile thread*. You must not shake your head at this, M. Gaudin is no quack. The Academy, at any rate, received his memoir with marked favour. Everybody knows that glass, when in a state of fusion, may be drawn out into very slender threads; and M. Gaudin having succeeded in melting down rock salt, discovered that it was susceptible of the same modifications as vitreous substances,—that it could be wound round a bobbin, or converted into a solid tissue at will. But of what use, you may say, is this discovery? According to M. Arago there are various ways of turning it to a good account. The Torsion balance (*la balance de torsion*), which in the hands of Coulomb has proved so useful, is rendered *uncertain* by the variable elasticity of the wires which support the electric or magnetic needle. To remedy this defect, there can be no surer way than to substitute rock salt threads for the metallic wire now employed. There are other applications equally interesting. For instance, something is still wanting to give to the oscillations of the pendulum a mathematical certainty. It is hardly necessary to allude to the multitudinous uses of pendulums: yet, when the wire of a pendulum is metallic, we cannot say what modifications it may experience in length during an operation; but if we substitute M. Gaudin's rock salt thread, the results, there is reason to hope, will be more conclusive. The importance of M. Gaudin's discovery, so far as the chemical sciences are concerned, is also great. There is a class of phenomena—those that have reference to the internal organization or molecular juxta-position of bodies—with the nature of which we are

still but imperfectly acquainted. The modern discoveries respecting light and colours show that certain effects result from the properties of the molecules themselves, others from their agglomeration: it is more than probable that this discovery will throw further light on the subject.—*Athenæum.*

NEW MODE OF DESTROYING LIFE FOR THE PURPOSES OF HUMAN FOOD.

[Extracted from "Scientific Memoranda." By W. H. Weekes, Esq. Privately printed.]

To the philosopher and the humanely disposed man of science, most of the ordinary modes of depriving those animals of life, which are fitted by nature for our food, must surely have often constituted a source of deep and painful interest. The barbarity exercised towards the poor calf, in slowly progressing his flesh to that delicate state of whiteness suited to the *refined sensuality* of the epicure, ought long since to have been repressed by an act of our legislature, to say nothing of battering in the skull of the ox, after mercilessly dragging him, by the torture of ropes and engines, to the arena of his slaughter; the agonies of sheep, swine and other victims to the knife of an unfeeling butcher, often degraded by habit and circumstance much lower in the scale of being than those brutes over whom he exercises his revolting but wonted cruelty.

It has often and long since occurred to me that some one of the gases known to chemists as being not only inimical to vitality, but speedily destructive of animal life, might be appropriately resorted to as a remedy for the evils to which I have referred. An elastic gum bag of moderately large dimensions securely applied over the mouth and nostrils of the ox or other animal, being first charged with carburetted hydrogen, would in a few seconds extinguish every remnant of sensation, when the large arteries of the neck might be divided, *and the flesh rendered fit in every respect as we now find it for the use of man.* Supposing a gas-holder of *sufficient capacity*, as above suggested, *not easily applied;* let one of manageable dimensions be connected by means of an air-tight hose or elastic tube, with *a main reservoir*, in which an adequate quantity of gas might always be kept in readiness, without any serious tax upon the economy of any party. *A most eligible plan would be to drive the animal into a properly constructed chamber charged with an artificial atmosphere of the gas, if means could be devised whereby the operator could immediately after enter and complete the requisite subsequent attention.*

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 25TH OF APRIL AND THE 25TH OF MAY, 1839.

John Boyd, of College-street, and Hugh Francis Rennie, of Glengall-street, Belfast, flax-spinners, for certain improvements upon the spinning frame used for spinning flax, hemp, and tow, upon the wet principle. Sealed April 30; six months to specify.

Julian Skrine, of Cambridge, Esq., for improvements in manufacturing forks and spoons, coins and medals. April 30; six months.

James Smith, of Deanston Works, Kilmarnock, cotton-spinner, for certain improvements in the machinery for spinning and twisting of wool and other similar fibrous substances. April 30; six months.

John Rostron, of Edenfield, Lancaster, manufacturer, for certain improvements in the construction of looms for weaving. April 30; six months.

Joseph Hunt, of Dalston-terrace, Middlesex, gentleman, for improvements in the manufacture of soda and other valuable products from common salt. May 7; six months.

David Naylor, of Copley Mill, Halifax, manufacturer, and John Crighton, jun., of Manchester, machine-maker, for certain improvements in machinery for weaving single, double, and treble cloths by hand or power. May 7; six months.

George England, of Gloucester-terrace, Vauxhall-bridge Road, engineer, for an improved screw-jack for raising or moving heavy bodies both vertically and laterally. May 7; six months.

William Davis, of Leeds, machine-maker, and George Kinder, of Aldmondsbury, cloth-dresser, for certain improvements in machinery for dressing and cleansing woollen cloths. May 7, six months.

Joseph Maudslay and Joshua Field, of Lambeth, engineers, for improvements in the construction of marine steam-engines, which are particularly applicable to steam-engines of the largest class. May 7; six months.

James Whitelaw, of Glasgow, for an improved rotary machine to be worked by the pressure and re-action of a column of water, which machine may be used as a steam-engine; also an improved water-meter, and a machine for raising water or other liquid by its centrifugal force. May 7; six months.

Edward Oliver Manby, of Swansea, civil engineer, for a new method of manufacturing gas for the general purposes of illumination. May 8; six months.

Germain Le Normand De L'Osier, of the Tavistock Hotel, Covent-garden, merchant, for improvements in machinery for raising water. May 8; six months.

Richard Prosser, of Birmingham, civil engineer, for certain improvements in machinery for making nails and screws. May 8; two months.

William Harper, of Cooper's Court, Cornhill, patent stove manufacturer, and Thomas Walker, of Birmingham, machinist, for improvements in stoves and grates. May 10; six months.

George Stocker, of Birmingham, Warwick, brass-founder, for certain improvements in cocks or apparatus for drawing off liquids. May 13; six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements in reducing the friction of axletrees and axletree boxes, and other such moving parts of machinery. May 13; six months.

John Henry Rodgers, of Birmingham, merchant, for improvements in clasps or fastenings, principally applicable to certain articles of dress. May 13; six months.

John Williamson Whittaker, of Bolton, joiner, and Rowland Hall Heaton, of the same place, cotton-spinner, for certain improvements in the means of connecting or uniting straps or bands for driving machinery and other similar purposes, and in the apparatus for effecting the same. May 20; six months.

John George Bodmer, of Manchester, engineer, for certain improvements in machinery tools, or apparatus for cutting, planing, turning, drilling, and rolling metals and other substances. May 20; six months.

John Walker, of Allen-street, Lambeth, Surrey, oven builder, for certain improvements in coke ovens. May 22; six months.

James Vardy, of Wolverhampton, gentleman, for improvements in rolling iron. May 22; six months.

William Jefferies, of Holme-street, Mile End, metal refiner, for certain improvements in the process of smelting or extracting metal from copper, and other ores. May 22; six months.

Thomas Harper, of the Grange, near Newnham, Gloucester, merchant, for certain improvements in railways or tram roads. May 22; six months.

Nicholas Troughton, of Leicester-street, Regent-street, gentleman, for improvements in obtaining copper from ores. May 22; six months.

Nicholas Troughton, of Swansea, Glamorgan, for improvements in the manufacture of zinc. May 22; six months.

Henry Griffiths, of Acton-place, Camden Town, Middlesex, artist, for improvements in the process of producing prints, or impressions from steel, copper, and other plates. May 25; six months.

Martial Augustin Joseph de Herrypon, of Leicester-street, Saint Martin-in-the-fields, mining engineer, for an improved machine or apparatus for washing and bleaching wool, cotton, silk, linen, and other fibrous materials either in a manufactured or unmanufactured state. May 25; six months.

Thomas Clark and Charles Clark, of Wolverhampton, iron-founders and copartners, for an invention for glazing and enamelling cast iron hollow ware, and other metallic substances. May 25; six months.

Benjamin Hick, of Bolton, engineer, for certain improvements in machinery or apparatus for drying cotton, woollen and other fabrics, and other fibrous substances or materials. May 25; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22nd OF APRIL AND THE 22nd OF MAY, 1839.

John Hillard, in consequence of a communication from a foreigner residing abroad, for certain improvements in machinery or apparatus for making or manufacturing screws. Sealed April 24; four months to specify.

James Nasmyth, of Patricroft, near Manchester, engineer, for certain improvements applicable to the bearings or journals of locomotive and other steam engines, which improvements are also applicable to the bearings or journals of machinery in general. April 24.

George Price, of Cornhill, London, gentleman, in consequence of a communication from a certain foreigner residing abroad, for of improvements in filtering and clarifying water and other liquids. April 30.

William Pontifex, of Shoe-lane, London, coppersmith, for improvements in apparatus or materials employed in filtering and clarifying water and other liquids. April 30.

James Smith, of Deanston Works, Kilmarnock, Perth, cotton spinner, for improvements in the machinery for spinning and twisting of wool and other similar fibrous substances. April 30.

Thomas Barnabas Daft, of Regent-street, Middlesex, gentleman, for certain improvements in inkstands, and in materials and apparatus for fastening and sealing letters. April 30.

Elisha Haydon Collier, late of Boston, North America, but now of Globe Dock Factory, Rotherhithe, Surrey, civil engineer, for improved machinery for manufacturing nails. April 30.

Matthew Heath, of Furnival's Inn, gentleman, in consequence of a communication from a certain foreigner residing abroad, for an invention of improvements in clarifying and filtering water, beer, wine, and other liquids. April 30.

James Whitelaw, of Glasgow, North Britain, for an improved rotatory machine, to be worked by the pressure and re-action of a column of water, which machine may be used as a steam-engine; also an improved water meter, and a machine for raising water or other liquid by its centrifugal force. May 17.

William Watson, of Temple-street, Dublin, gentleman, for an improvement in the construction of ships, and which improvement is also applicable to all kinds of sea-going vessels; and also certain improvements in the construction of boats, and other vessels intended to be used in canals and inland navigation. May 20.

NOTES AND NOTICES.

Photogenic Drawings.—Mr. Robert Mallet has communicated to the Royal Irish Academy a notice of the discovery of the property of the light emitted by incandescent coke to blacken photogenic paper; and proposed it as a substitute for solar light, or that from the oxy-hydrogen blowpipe with lime. One of the most important applications of the photogenic process, as yet suggested, is its adaptation to the self-registering of long-continued instrumental observations. Unless, however, an artificial light, of a simple and inexpensive character, can be found to supply the place of solar light at night, the utility of this application will be much limited. Few artificial lights emit enough of the chemical rays to act with certainty on the prepared paper: while those which are known to act well, as the oxy-hydrogen lime light, are expensive, and difficult to manage. A considerable time since, the author discovered that the light emitted by incandescent coke, at the "Twyer" (or aperture by which the blast is admitted) of a cupola or furnace for melting cast iron, contained the chemical rays in abundance; and on lately trying the effect of this light on the prepared paper, he found it was intensely blackened in about forty five seconds. In the single experiment made, the heat, which was considerable, was not separated from the light; but the author purposed to make further experiments, in which this precaution will be attended to. There is no difficulty to be apprehended in contriving an apparatus to burn a small quantity of coke at a high temperature. A diagram of an apparatus for this purpose was shown.

Method of Perforating Glass.—Put a drop of spirits of turpentine on the place where the hole is to be made, and in the middle of this drop a small piece of camphor. The hole can then be made without difficulty by means of a well-tempered borer, or triangular file. Solid turpentine answers as well as a mixture of the oil or spirit, and camphor.—*Annales des Mines.*

The thirtieth Volume of the *Mechanics' Magazine* will be published on the 1st of July, illustrated with a splendid engraving of a LOCOMOTIVE ENGINE AND TENDER—the size of a sheet and a half of demy paper—exhibiting the whole of the machinery of the engine, and explaining its action.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough-court, Fleet-street.*—Sold by A. & W. Galignani, Rue Vivienne, Paris.

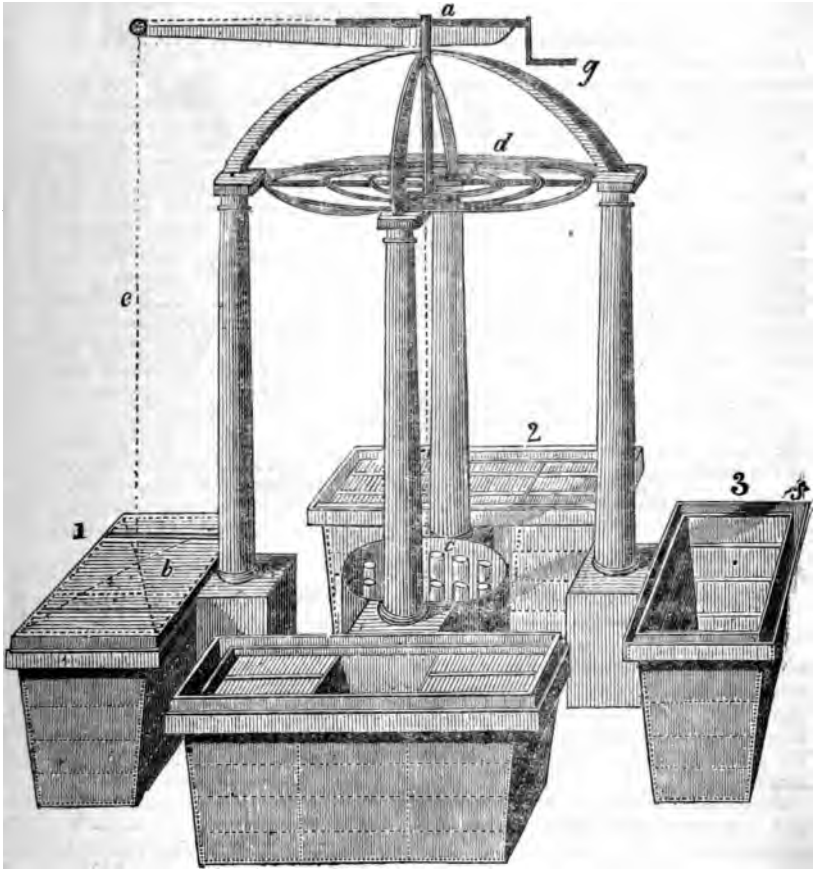
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 826.] SATURDAY, JUNE 8, 1839. [Price 3*d.*

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

HUTCHISON'S DRY LIME GAS PURIFYING APPARATUS.



HUTCHISON'S DRY LIME PURIFYERS, AND SUSPENSION APPARATUS.

The engraving on the front page represents a new adaptation of a purifying apparatus, erected at the works of the London Gas Company by Mr. Hutchison.

It consists of four distinct tanks; each one contains four tiers of perforated shelves, charged with a layer of lime. The gas is conveyed from the condensers to the circular hydraulic tank, *c*; this tank contains four inlet and the same number of outlet pipes; these pipes convey the gas into, and from, the square purifyers, Nos. 1, 2, 3, and 4 in succession.

This novel arrangement is well adapted for most gas-works, in consequence of the limited space it occupies, and being so placed as to be all together under the immediate observation of the purifying attendant.

In the figure, *a* is a horizontal revolving lever, worked by a travelling and stationary screw, to which is attached the chain *e*, this chain suspends the cover, *b*, of the purifyers, during the process of clearing out the saturated lime; *f* represents the purifying tank without the lime shelves, and surrounded by an hydraulic joint intended to prevent the escape of gas.

No. 2 shows the tank occupied by the lime shelf. *d* is a stage upon which stands the person who turns the lever by means of the handle *g*. C.

FONTAINEMOREAU'S NEW ALLOYS OF ZINC—A SUBSTITUTE FOR BRONZE, COPPER, AND BRASS.

An invention of a new alloy of zinc, with small proportions of other metals, found to possess very peculiar advantages, has lately been introduced into England, where it has been patented in the name of M. Lecomte de Fontainemoreau. It is likely to prove of great utility in the manufacture of machinery; and in castings relating to the fine arts, as a substitute for copper and bronze, will be extensively adopted. We suggested it as a material for casting the Nelson memorial, and we beg to reiterate the suggestion to the various committees now engaged in *the formation of that, and* other national *testimonials.*

The proportions of metals which have been found most advantageous in forming varieties of the alloy, after very numerous and extensive experiments, are as follows:—

No. 1.

Zinc	90 parts
Copper	8 ..
Cast Iron	1 ..
Lead	1 ..
	100 parts.

No. 2.

Zinc	91 parts
Copper	8 ..
Lead	1 ..
	100 part .

No. 3.

Zinc	92 parts
Copper	8 ..
	100 parts.

No. 4.

Zinc	99 parts
Copper	1 ..
	100 parts.

No. 5.

Zinc	97 parts
Copper	$2\frac{1}{2}$ ..
Cast Iron	$\frac{1}{2}$ ..
	100 parts.

No. 6.

Zinc	97 parts
Copper	3 ..
	100 parts.

No. 7.

Zinc	$99\frac{1}{2}$ parts
Cast Iron	$\frac{1}{2}$ ..
	100 parts.

No. 8.

Zinc	$91\frac{1}{2}$ parts
Copper	8 ..
Cast Iron	$\frac{1}{2}$ ..
	100 parts.

The proportions stated of any of these metals may be slightly varied, so long as by such variation the alloy is not made too brittle or too soft; for instance, the proportion of copper may be varied from about one part to about twelve parts in every hundred, but any greater proportion of copper than this, and less than that used in forming common brass would make the alloy brittle. The proportion of cast iron may be varied from about one-quarter of a part to about two parts in every hundred. The proportion of lead may be varied from about one to twenty-four parts in every hundred parts, but the presence of some third metal is necessary to produce a proper combination of the zinc and lead. Instead of pure copper or any other of the simple metals directed before to be used, brass or other alloys formed of these metals may be used; but where this is done, the quantity of copper and other simple metals contained in such alloys must be taken into account in calculating the relative proportions of simple metals which the new alloy is to contain in reference to the tables of component parts.

The principal object of the addition of the small quantities of copper, cast iron, and lead, to the larger proportions of zinc, is to change the manner of the crystallization of the zinc, after it has been fused and set to cool.

The new alloys are of a closer texture, more homogeneous and malleable than simple zinc, and some kinds of iron; are less liable to oxidation, and of a much finer grain than zinc, somewhat resembling that of steel, especially when the alloys are rolled; they are also easier filed than either zinc, copper, or brass, and the filings do not stick in and clog the file.

By casting the new alloys in metallic moulds, their hardness and homogenity is increased, and a sort of temper is imparted to them, resembling, or approaching to, the temper of steel.

For the purpose of rendering the alloys, which are of a silvery grey colour, perfectly suitable as substitutes for copper, bronze, brass, and other metals, the colours proper to the metals of which they are intended to be substitutes, is imparted to them by means of any solution of copper. *The hydro-chlorate of copper is found to answer best.*

Firstly, for giving the alloys a blackish bronze colour, they are treated with a solution of the salt of copper, diluted with a considerable quantity of water, and a small quantity of nitric acid may be added. Secondly, to impart a red or copper colour, add to the solution of salt of copper, liquid ammonia, and a little acetic acid; the salt of copper may be dissolved in the liquid ammonia. Thirdly, to impart a brass or antique bronze colour, either of the three following means may be adopted: first, a solution of copper with some acetic acid; second, the means above described for copper colour, with a larger proportion of liquid ammonia; third, water acidulated with nitric acid, by which beautiful blueish shades may be produced. It must be observed, however, that this last process can only be properly employed on the alloys which contain a portion of copper. In either of these methods of colouring, a solution of sal ammoniac may be substituted for the liquid ammonia. The quantities of each ingredient have not been stated, as these depend on the nature of the alloy, the shade or hue desired, and the durability required.

The blackish bronze colour may be superadded to the red or copper colour, whereby a beautiful light colour is produced on the prominent parts of the article bronzed, or on the parts from which the blackish bronze colour may have been rubbed off.

These new alloys may be used as substitutes for various metals now in general use, such as iron in various parts of machinery; iron, lead, tin, or copper, in pipes and tubes; and bronze, brass, and copper in machinery and manufactories, as well as for most of the other purposes for which more expensive metals are employed.

ENGRAVING BY GALVANISM.

Sir,—Observing in the last page of a recent number of your Magazine, a notice extracted from the *Athenæum*, relative to a discovery of Professor Jacobi, its perusal occasioned the recollection of some experiments performed, about the commencement of last summer, with the view of obtaining impressions from en-

graved copperplates, by the aid of galvanism, which lead me to infer some analogy in *principle* with those of the Russian professor, and may probably give me the right to claim priority in its discovery and application. These experiments were abandoned from the want of that most important element in pursuits of this nature—*time;* the writer's share of the said element being occupied in a manner more imperative than pleasing. I regret, however, not having made it the subject of an earlier communication, as this would have placed my pretensions beyond doubt; but inasmuch as the notice alluded to is given from memory, and is undescriptive, whilst I may be enabled to exhibit the *modus operandi*, my assertion may be at least partially substantiated.

It is well known to experimentalists on the chemical action of voltaic electricity, that solutions of several metallic salts, are decomposed by its agency, and the metal procured in a free state. Such results are very conspicuous with copper salts, which metal may be obtained from its sulphate (blue vitriol) by simply immersing the poles of a galvanic battery in its solution—the positive wire becoming gradually coated with copper. This phenomena of metallic reduction is an essential feature in the action of *sustaining* batteries, the effect, in this case, taking place on more extensive surfaces. But the form of voltaic apparatus which exhibits this result in the most interesting manner, and relates more immediately to the subject of the present communication, may be thus described:—It consists of a glass tube, closed at one extremity with a plug of plaster of Paris, and nearly filled with a solution of *sulphate of copper;* this tube and its contents is immersed in a solution of *common salt*. A plate of copper is placed in the first solution, and is connected by means of a wire and solder, with a zinc plate which dips into the latter. A slow electric action is thus established through the pores of the plaster, which it is not necessary to mention here; the result of which is the precipitation of minutely crystallized copper on the plate of that metal, in a state of greater or less malleability, according to the slowness or rapidity with which it is deposited. In some experiments of this nature, on removing the copper thus formed, I remarked that the surface in contact with the plate equalled the latter in smoothness and polish, and mentioned this fact to some individuals of my acquaintance. It occurred to me, therefore, that if the surface of the plate was *engraved*, an *impression* might be obtained. This was found to be the case; for on detaching the precipitated metal, the most delicate and superficial markings, from the fine particles of powder used in polishing, to the deeper touches of a needle or graver, exhibited their corresponding impressions in *relief* with great fidelity. It is, therefore, evident that this principle will admit of improvement, and that casts and moulds may be obtained from any form of copper.

This rendered it probable that impressions might be obtained from those other metals having an electro-negative relation to the zinc plate of the battery. With this view, a common printing type was substituted for the copper plate, and treated in the same manner. This also was successful; the reduced copper coated that portion of the type immersed in the solution. This, when removed, was found to be a perfect matrix, and might be employed for the purpose of casting, where time is not an object.

It appears, therefore, that this discovery may possibly be turned to some practical account. It may be taken advantage of in procuring casts from various metals, as above alluded to; for instance, a copper die may be formed from a cast of a coin or medal, in silver, type metal, or lead, &c., which may be employed for striking impressions in soft metals. Casts may probably be *obtained* from a *plaster* surface surrounding a plate of copper; tubs or any small vessel may also be made by precipitating the metal around a wire, or any kind of surface, to form the interior, which may be removed mechanically, by the aid of an acid solvent, or by heat.

C. J. JORDAN.

May 22, 1839.

HEATON'S LOCOMOTIVE-ENGINE CRANK BALANCE.

Sir,—In your Magazine of May 25, No. 824, page 117, is a letter from Mr. Richard Evans, in which he says, *he fears I shall find I have been forestalled* in the invention of the application of

balance weights to locomotive engines upon railways. For my part I have no fear of the sort, for whether or not it is my invention or any other person's, if I have only been instrumental in the general adoption of (as Mr. Evans says) so useful an invention, I am quite satisfied. That the balancing of machinery is not new every practical mechanic knows right well, and some hundreds of these have seen in a locomotive engine made by myself and brothers (for the common road) seven years ago, that not only the cranks, but all other moving parts were balanced. Mr. Evans says, that in December last, the eminent firm of Sharpe, Roberts and Co., of Manchester, used this useful appendage, for which they make no claim of originality, having previously seen it applied to a locomotive upon the London and Southampton Railway. The invention or application they attribute to Mr. Dawson, attached to that line. Mr. Roberts, he says, quite confirms my conclusions as regards its use, and that he (Mr. Roberts) has made an improvement in the form of Mr. Dawson's balance, by applying a little additional substance to the periphery of the wheel only. If Mr. Evans will take the trouble (when in Birmingham) to call upon Mr. Dockry, the resident engineer of the London and Birmingham Railway, that gentleman can show him a *model* of a crank shaft, and two wheels, with the balance weights placed exactly as he describes them to be upon Messrs. Sharpe, Roberts and Co.'s engines, which model has been in Mr. Dockry's possession from the beginning of October last, and has been examined by many eminent engineers attached to the London and Birmingham, and most other Railway Companies. This model I was requested to make by one of the Directors of the London and Birmingham line, some time in August, or the beginning of September last, for the purpose of testing practically an assertion made by me, that balance weights would not only prevent the rocking of the engines, but would also produce a considerable saving of power.

Your obedient servant,

G. HEATON.

Shadwell-street Mills, Birmingham.

MATHEMATICAL QUESTION.—PUMPING WATER.

Sir,—Having sometimes seen mathematical problems, &c., in your instructive miscellany, I shall be obliged to you for the insertion of the following question. It was given to me as the "crack" examination-question at the University of Cambridge, with something like a defiance to any non-collegian to solve it. I also transmit a solution and proof of it by one of my pupils. You will have the goodness to withhold his operation for the present, that the question may exercise the ingenuity and skill of some of your intelligent correspondents, several of whom can, I doubt not, furnish a correct solution.

Now that my pen is in hand, I must be allowed (through the medium of your extensively circulated Magazine) to remind sciolists, deriding "Literates" and other students for not having the advantages of a university education, that *real* scholars, who constitute the glory of a university, are among the foremost to foster talent in humble life; that some of the greatest linguists and mathematicians the world ever saw never entered a university at all, or did not proceed thither, till their acquirements had attained celebrity; that the editor (for many years) of the most distinguished literary journal in Europe was taken from a shoemaker's shop; that one of the most eminent scholars now living, a professor in an English university, laboured at a carpenter's bench; that a renowned linguist, not long since deceased, was raised to be a professor in another British university from the humble occupation of a herd-boy; and that, in short, the expressive French adage admits of most extensive application—"C'est la roue du cuivre qui fait mouvoir l'aiguille d'or."

Wishing increased success to a Magazine which has elicited the talents and cherished the efforts of "mechanics" and their friends,

I remain, Sir,

Your obedient servant,

J. W. PIGG.

St. Simon's Academy, Norwich,
May 20, 1839.

Mathematical Question.

Into a cubic cistern eight feet deep, and having an unknown leak, water is

poured from two pumps, worked by two men, A and B. They pump till it is half filled, when B falls asleep. A continues pumping till it is three quarters filled, and then goes away. B afterwards waking, finds the cistern still half full; and after pumping till it is again three quarters filled, departs also, and meeting with A, charges him with leaving his work unfinished. They return together, and find the water one inch and a half lower than when B left. The leak is now discovered and stopped; and by their joint efforts the cistern is filled in half the time they worked together at first. They remark also that ten hours and twenty minutes had elapsed since they first began pumping, and that B had worked alone twice as long as A. Supposing that a cubical foot contains fifteen and five-eighths of a gallon, it is required to find the quantity of water thrown in by each pump?

MR. WOOLHOUSE'S EDITION OF TREDGOLD ON THE STEAM-ENGINE.

Sir,—Having, in the last number of your Magazine, attributed to me the formation of the practical rules at the end of the new edition of Tredgold's work on the steam-engine, I beg to state in justice to my highly-gifted friend Mr. Woolhouse, that those rules were made by him, the index being the only part prepared by me. I may, perhaps, also be permitted to state, that in my opinion Tredgold's work, with all its real and fancied imperfections, is far superior to any other that has appeared on that important subject, although both it and the editor have been assailed by feelings the most malignant that perhaps ever disgraced the pages of periodical criticism.

Professor Mosely in the true spirit of science, after making some strictures on the above-named work, observes:—

"That work contains a vast mass of practical information, which will be sought for in vain elsewhere, and the many admirable plates and valuable papers which have been added to the last edition of it, published by Mr. Weale, will no doubt obtain for it a place in the library of every man interested in the progress of practical science. Nevertheless, in justice to the real interests of *science, the author is* compelled to express *an opinion, that every single* question connected with the theory of the steam-engine, ought in the existing state of our knowledge to be received with distrust and caution." See *Illustrations of Mechanics*—p. 386.

Men who are deeply interested in the progress of science, are generally cautious in their condemnation, whilst the ignorant pretender is sweeping in his assertions, but extremely slow in the supporting of them.

I am, Sir,
Your obedient servant,
JAMES HANN.

King's College, June 4, 1839.

WHITWORTH'S IMPROVED PUMP.

Sir,—I take the liberty to send you a plan of the working part of a common pump, constructed upon a new principle, which I conclude will be very apparent to all persons acquainted with a pump. The principle aim of the inventor has been to save the trouble and expense of packing large pumps, which in some is a process of very frequent occurrence.

Fig. 1, *a a* is the whole length of the working barrel, cast in two parts, and constructed so as to form, when put together, a kind of recess in each part, for the introduction of segments, *b b*, round the external surface of the bucket, which will work against the segments, and may be tightened in a few minutes by turning the screws *c c*, and of course save the trouble of drawing and packing with leather, as is usually done. The two parts of the working barrel are screwed firmly together by means of four bolts, set at right angles to each other, and of the same shape and form as fig. 3: through the centre of each bolt is a screw set-pin, to bear upon the wedge-shaped segment *b b*; two only are shown. The shell bucket (if rightly termed) is made of brass, about half the length of the working barrel, of the same shape and form as fig. 4, which is turned true, and fitted with exactness. The valves at the top of this bucket work in a perpendicular position, by means of grooves cast into each side, and these grooves are interlined on each side with wood, to protect the parts from wearing by the action of the water. Fig. 2 is a section or inside view, which every person that understands a pump will soon make himself acquainted with. If you think there is

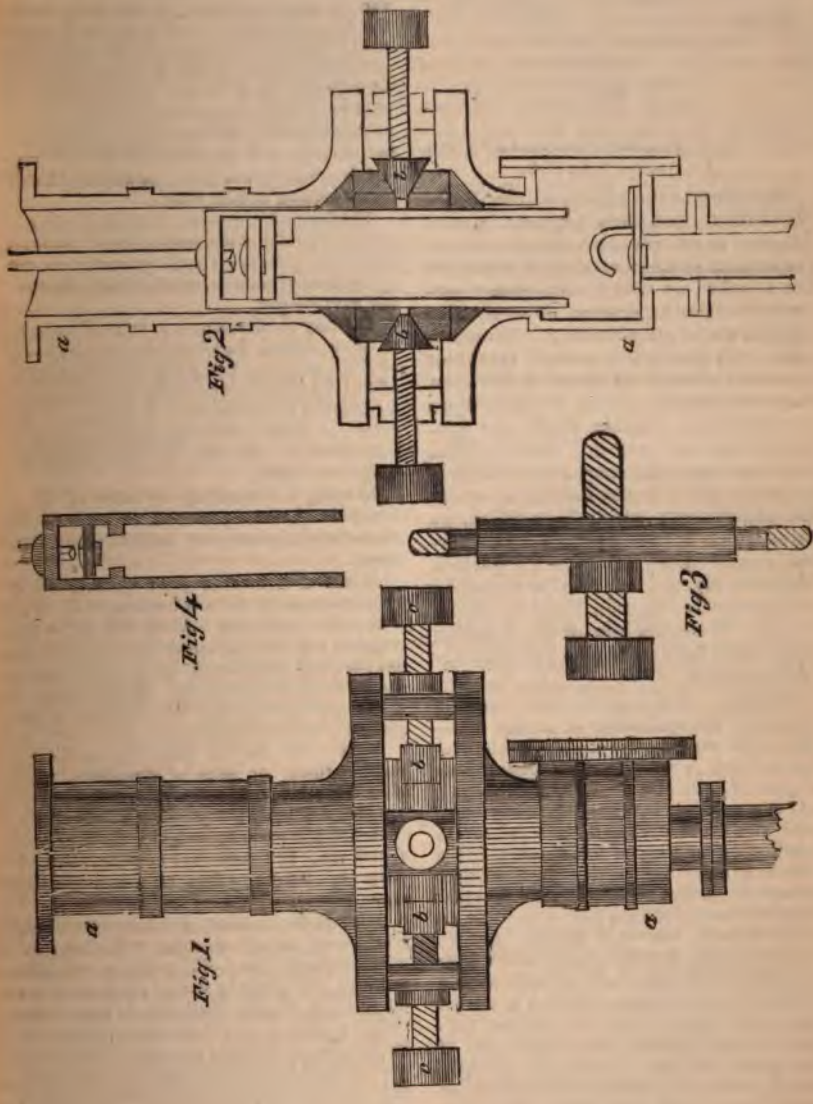


Fig. 2.
Fig. 3.
Fig. 4.
Fig. 1.

sufficient merit in the invention to make it worth publication, you are at liberty to do so.

I am, Sir,

Yours, &c.,

THOMAS WHITWORTH.

Royston, near Manchester,
May 22, 1839.

CLAY AND SMITH'S IMPROVEMENTS IN GLASS MAKING.

Referring to the lecture at the Royal Institution, upon the glass manufacture, reported in our present number, a correspondent (a member of the Institution) has supplied us with the following particulars of the application of some new ingredients in glass-making. We quite agree with him in his remark that new processes should be more dwelt upon than they usually are in lectures upon manufactures, whether these new processes have or have not been adopted and found advantageous; it is of nearly as much utility to publish to the world the experiments which have failed, as those which have succeeded. Our correspondent has not stated whether Messrs. Clay and Smith's combination of ingredients has been found to answer or not. We thank him for the flattering remarks he has made upon the character of our reports.

"Messrs. Clay and Smith's invention consists in the application of certain materials in the manufacture of glass, not heretofore so used, by which various descriptions of glass of an excellent quality are obtained, and at a reduced cost; such materials being used with the matters now employed, or in substitution for some of these matters in the various mixtures for making glass, which is brought to market under various denominations, the names of such glass depending, in some respects, on the process through which it passes, and the uses to which it is applied; but all glass-making may shortly be stated to be the fusing of silica at a great heat, with certain saline or alkaline substances, and, in some cases, the oxides of lead at the same time. There are probably no two glass-makers engaged in making glass which is sold by the same name, who would agree as to the mixtures to be used; and no two makers, either of flint glass, crown *glass, plate glass, or glass* under other names, employ the same quantities of ingredients; and, in some cases, different makers vary the materials from which the same named glass is manufactured. It would, therefore, be impossible to set forth any general rule of glass-making for any of the various named glasses; at the same time, the materials which Messrs. C. and S. apply to the purpose of improving the glass manufacture in general, will, with greater or less advantages, apply to the various mixtures used by different glass manufactures. Such mixtures of silex, and the materials ordinarily in use, with such quantities of the new materials are therefore given, as will be suitable to the making of flint glass.

The invention consists, first, in the application of combinations and salts of barium, strontium and zinc; and, secondly, in the application of granitic, or other rocks abounding with felspar.

In using combinations, or salts of barium, or of strontium, the carbonates of barytes or strontia which are found native in some parts of this kingdom, are preferred; or otherwise, for them to be in the state of sulphate of barytes; in which latter case there is mixed a proportion of charcoal, or other carbonaceous substances.

In using combinations or salts of zinc, the oxide of zinc is preferred, which is formed during the process of manufacturing that metal.

Mixture for making glass by combining combinations, or salts of barium, with silex and other materials: Sand 320 parts by weight; red lead, 150 parts by weight; carb. barytes, 145 parts by weight; carb. potash (pearl ash,) 112 parts by weight; nitre, 7 parts by weight; some little oxide of manganese (the usual quantity.)

Mixture for making glass by combining combinations, or salts of strontium, with silex and other materials: Sand, 320 parts by weight; red lead, 150 parts by weight; carb. strontia, 108 parts by weight; carb. potash (pearl ash,) 112 parts by weight; nitre, 7 parts by weight; oxide of manganese as usual.

Mixture for making glass by combining compounds, or salts of zinc, with silex and other matters: Sand, 320 parts by weight; red lead, 150 parts by weight; oxide of zinc, 56 parts by weight; pearl ash, 112 parts by weight; nitre, 7 parts by weight; oxide of manganese, some little as usual. In some cases red lead (oxide of lead,) is not used, but then the quantities of carb. barytes, carb. strontia, and oxide of zinc, respectively, must be doubled.

Other descriptions of glass are made with the following mixtures:—

	Parts by weight.
Sand	480
Carb. barytes	300
Carb. soda (pure)	165
Little oxide of manganese.	

	Parts by weight.
Sand	480
Carb. strontia	224
Carb. soda (pure)	165
Little oxide of manganese.	

	Parts by weight.
Sand	480
Oxide zinc	120
Carb. soda (pure)	165
Little oxide of manganese.	

	Parts by weight.
Sand	280
Chalk	88
Sulph. soda	84
Sulph. barytes	90
Charcoal	8
Little manganese.	

	Parts by weight.
Sand	960
Chalk	200
Sulph. soda	290
Sulph. barytes	460
Charcoal	40
Little manganese.	

	Parts by weight.
Sand	960
Chalk	200
Sulph. soda	290
Sulph. strontia	370
Charcoal	40
Little manganese.	

These mixtures form cheaper glasses, as they enable the manufacturer to use less alkaline or saline substances than before.

The following are mixtures of the application of those rocks in which felspar predominates, and which, at the same time, contain very little or no oxide of iron; as, for instance, a mineral found in Cornwall, and used in the potteries under the name of "Cornish Stone;" this is used in conjunction with common salt or muriate of potash, and these mixtures are found to afford good and cheap glass.

	Parts by weight.
Cornish stone powdered fine as sand	100
Common salt	12
or	
Muriate of potash	16
Chalk	20

	Parts by weight.
Cornish stone powdered fine as sand	100
Common salt	16
or	
Muriate of potash	22
Chalk	16

The important feature of this invention is, in some cases, to reduce the necessity of using so much red lead, in other cases, to dispense with the use of red lead altogether, and, in other cases, to reduce the extent of using alkaline or saline substances, by the application of other materials. Hence, supposing a glass-maker is about to apply any of the new substances, and supposing him to have a particular mixture of his own, which, as before stated, is most generally the case, he will apply some one or more of the matters herein mentioned: for it is not necessary that only one of the matters should be employed in any particular mixture. The inventors claim as new, first, the application of compounds, or salts of barium, strontium, and zinc, in combination with silica and other materials, in the manufacture of glass; and, second, the application of granitic or other rocks in which felspar predominates, in the manufacture of glass.

RAILWAYS—STEAM NAVIGATION—MACHINERY AND MANUFACTURES IN AMERICA.

Great rail-roads are made, and still making, at the South. Charleston and Cincinnati are to be bound together—only 700 miles—and so on. I expect shortly to see lines of steam-packets to Europe from New Orleans, Charleston, Norfolk, to Liverpool, London, Havre. Really one's brain gets dizzy with all this noise of preparation. And yet I must push on, *à l'Américaine*, for a "Western Passage to China!" It is a sign of the times, that such a project as this should be conceived, mentioned and discussed. A writer here argues the matter thus: The China voyage now takes up a year or more. For various reasons, and, not least, from the great distance of tropic to be traversed, our products *are not carried out: for the teas, silks, and ware brought home, we give* almost exclusively silver and gold. This is no small drain. We take 180,000 boxes of tea yearly, and as much silk. Now what we want is a fair barter trade; we want the Chinese labourers, among other things, to eat something besides rice; and why not to use our cottons, as in India? Well! we must have a new route. The Isthmus of Darien won't do,—hilly, tropical, and indirect: besides, we don't *own* it. We must traverse our own land. The Missouri and Columbia rivers indicate the way. Steamboats may mount the latter almost to the foot of the mountains, and it is only 600 miles from the head of steam navigation on the Missouri to "Astoria" itself. In few words, a railroad of about 100 miles would connect the two rivers—the two oceans—

the two worlds. Of course the voyage by steam from from Astoria to China would be no "consideration" at all. The writer, who is a veteran Western man, expects twenty years hence to see more Asiatic goods enter the port of Astoria than any other in the States. A question of jurisdiction about Oregon may arise, but that will be soon settled. Colonization, meanwhile, is rushing on like a flood. Oregon will be all as Yankee as Texas in ten years. A company, with ten millions of dollars capital, is at this moment projected in Missouri, to form settlements on the Columbia; and parties of young men are going out from every section of the land. They go even from Illinois,—from Wisconsin, I verily believe. "Westward the star" moves on indeed. West!—West!—the "Great West"!—still further west!

I mentioned in my last a recent Report of one of the Secretaries on the subject of steam navigation. It includes a letter from Professor Hare, of Philadelphia, whose name is not unknown in England. He thinks the most productive cause of explosions is the undue heating of the metal, when there is a scarcity of water, by which an explosive gas is evolved. In addition to various scientific precautions, he agrees that legal measures must be had recourse to; and high-pressure steam prevented, or any drunken engineer or racing captain will always have the lives of the passengers in his power, and in jeopardy too. You may remember the ill-fated *Pulaski*. The Professor mentions that, notwithstanding the condensing engine, he saw a pressure of 28 lbs. to the square inch allowed on board that boat! On board the *Great Western*, I think the maximum is 3½. A safety-valve, accessible to all, and to be inscribed in large letters with the extreme pressure allowed, ought to be in universal use. I am not sure but some of the boats have lately adopted it.

There is always some practical mania raging in this community, and frequently half-a-dozen, to suit different tastes. Just now a pretty strong beet-root sugar party is springing up throughout the country. Congress has lately had this matter under favourable consideration, and, I believe, something will come of it.* Machinery is one of our minor practicalities. Of some little sallies lately in foreign countries, I have before spoken. These cases are occurring daily. Some of them may strike even *you* oddly; but what your worthy correspondent would say about them,—he who stated last year that *bells* could not be cast in this country,—I know not. At this moment, I understand there is an Englishman here, agent for a company, who are about to set up—in Monclova, Cohahuila, on the Rio del Notre, I think it is—*cotton factories! the first ever known in Mexico.* A vessel-load of machinery is also about to be shipped from this port, made just out of the city. I find that, last summer, there was an agent here from *Russia* to purchase machinery for the woollen factories in that country, and that his orders were executed at Lowell to the amount of 100,000 dollars. I believe the Lowell locomotives, as well as the New Jersey ones, which I mentioned before, have been exported. Of the Philadelphian manufacture of this article, you may judge a little by the performance of one last week, which drew a train of 45 cars freighted with 150 tons of nails and hoop iron and 28 men, and, including cars and engine, making a a gross weight of 223 tons, from Reading to Bridgeport, in Pennsylvania, at an average speed of 12⅛ miles per hour. The quantity of wood consumed was 1⅜ cords, which, allowing 2,000 lbs. to the cord, is 2,600 lbs., or 11 lbs. 10 oz. per ton, for the 40 miles, or 4⅗ oz. per ton per mile.

A word on another branch of our industry. We have lately had a fresh illustration of the repute of our navy abroad, of which, by the way, the mercantile part deserves better than the national. The present ship-builder to the *Sultan*, as mentioned by Stephens, is a Mr. Rhodes, of New York. He was, a few years since, a common workman, taken out by Mr. Eckford, another American* who preceded him in his present station. He is at this time building a third steamer for the Turks, and is to build a fourth; and then, it is said, he will try his hand at an immense man-of-war. Rhodes has already made the largest frigate which now sails the seas; and your officers call her, I hear, one of the finest.—*Athenæum.*

ON THE PARAMOUNT IMPORTANCE OF PROVISION FOR ESCAPE FROM FIRE.

[From a most impressive discourse delivered by the Rev. T. Binney, at the Weigh-house Chapel, on Sunday, May 26, on occasion of the late calamitous fire in Bucklersbury, where four persons perished in the flames.]

"Before I advance to the last and concluding remark, let me say that it becomes every one of you to take proper means and

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* *There is an able article on the subject in No. 103 of the North American Review, just received from Mr. Kennett.—Ed.*

* Our correspondent is, we suspect, in error here—Eckford was a Scotchman, and 20 years of age before he set a foot in the United States.—Ed.

proper precautions in your houses, as defensive against the occurrence of a calamity like this. I do not think it unbecoming the dignity of this place, unbecoming a religious exercise, unbecoming an exercise in which we principally aim at the salvation of your souls, to press upon your attention the propriety of taking all necessary, prudent, and proper precautions to preserve your houses from fire.

"Take therefore all proper precautions against the occurrence of this calamity. See to it that *you* are not negligent; see to it that *your servants* are not negligent; impress upon their minds the necessity of continual care and attention, and see to it that they *do* attend. Those of you that have property, feel it to be a duty to insure it—a duty to your children, to yourselves, and to society. Acquaint yourselves with the construction of your houses; with the possibility, and the means of escape. Our friend had very recently entered upon this house; the young men fled to the roof, but they did not know that they could escape that way; they did however escape.

"The family in every house ought to be acquainted with the modes and ways, which there are, of escaping from their habitation in case of fire; it would be well if there was a possibility of escaping from the roof of every house; where there is, the inmates ought to be well acquainted with that possibility, that they may not have to learn it when the hour of danger arrives, and perhaps leaves them not a moment to learn it in. This is a mere matter of plain common sense duty. In conversing with one of the firemen, whom I found to be a very intelligent man, and whose heart seemed deeply and gratefully affected by the thought, that *they* had been the means of saving two lives by their efforts, he mentioned to me, and I do not thing it beneath me or unbecoming this place or this day to repeat it, that he had recommended to many persons a very simple contrivance, by which children and females might be saved upon such an occasion. It was this; to have a capacious canvass bag, attached to a strong rope, the other end of the rope being tied firmly round the bed-post in a bed-room. It lies out of the way, it may be coiled up under the bed, but there it is, always ready; in that bag a man might place his children, and let them down from the window; somebody would soon be present to aid; he might let down females in this way; and then, last of all, throwing the rope from the window, he might, with a little energy and self-possession, himself *slide down the rope. This simple apparatus being kept in the room, would be always ready at a moment's notice, and prepared for any emergency.*

ROYAL INSTITUTION—IMPROVED WHALEBONE MANUFACTURE—HOOK'S ELLIPTOGRAPH—SHADOWLESS LAMP—MR. GRIFFITH'S LECTURE ON THE MANUFACTURE OF GLASS.

May 17.—*The Conversazione.*—Some very excellent specimens were exhibited in the form of whip-handles and walking-sticks of a new mode of uniting and manufacturing whalebone by Mr. E. Binyon. This we believe is a recent patent invention and an excellent one it is. The material is increased in beauty of appearance as well as rendered applicable to a variety of purposes for which in its natural state it is not suitable.

Mr. Hook exhibited his elliptograph and Mr. Cooper an ingenious, but simple, and therefore very useful running, or travelling guage, to ascertain the deviations, either in excess or deficiency of the rails in a railroad from the width apart assigned to them, and which are indicated by the movements of an index on a graduated and magnified scale. The instrument may be adjusted to any standard of distance, in which state the index stands at zero. We beg to refer our readers to descriptions of instruments for a similar purpose invented by Dr. Lardner, and described in our last vol. p. 370.

Mr. Hemming's shadowless lamp was on the table. The reservoir of oil is in a cylinder in the body of the stand, in which moves a piston resting on the surface of the oil, and having a hollow piston-rod, formed of sliding tubes on the telescope principle, through which the oil is forced up for the supply of the lamp by the pressure of a spiral spring upon the piston. Provision is made for the overflowing of the oil, and for raising the piston when a fresh supply of oil is required. The spring is of that kind as to be pretty equable in its pressure, but as equilibrium, with the hydrostatic pressure is effected only by a variation in the height of the column of oil, the failing force of the spring, as it expands, is compensated by a descent of the oil, which is a defect. On the other hand, if the power of the spring at the commencement, is too great, a needless overflowing of oil will be the result, and will continue, until its force is reduced to an equilibrium with the resistance, after which there will be a certain range of the piston wherein the column of oil will remain nearly of the proper height, but for how long a time, we are unable to say. We should be apprehensive also that friction would cause irregularities in the height of the column of oil, and occasion alternate ebbs and flows.

The Lecture.—Mr. Griffith's lecture "On the manufacture and working of glass." A few points only in this lecture will require notice, as it was principally occupied in

exposition of the manipulations which glass undergoes, in the conversion of it into various useful forms. These were ingeniously illustrated and explained—in the absence of the actual operations which were intended, but unfortunately failed—by a series of models representing the different stages of the proceeding, and by other models, showing the construction of the glass-house furnace, and the shape of the crucibles.

The Lecturer, after adverting to the other kinds of glass, addressed his observations more particularly to the manufacture of flint glass, which he remarked, owes its brilliancy and highly refractive power to the oxide of lead which is in its composition. The proportions generally observed in the manufacture, are—

Sand.....	100
Pearl-ash.....	30
Red lead	60

These materials require to be very pure, or the colour of the glass is injured. On one occasion, considerable loss was experienced, by the sand having been conveyed in a barge which previously had for its cargo a quantity of rusty iron. To correct a brown tinge in the glass, manganese is employed; and if too much has been used, this again is corrected by charcoal. Glass is essentially a silicate of potassa. Silex, though not obviously and sensibly an acid, may yet be regarded as such in a chemical point of view, for it acts in the same manner as a more powerful acid does in depriving a salt of a weaker acid. This silex combines with the potassa or the soda, to the exclusion of the carbonic acid in the carbonates of the same. The alkali is in excess in glass as it is commonly made. This is particularly observable as the Lecturer discovered a few years since, when glass is brought into the state of a fine powder; it will then, on being moistened, discolour the test paper. A still larger proportion of alkali, produces a kind of glass soluble in water, which has the property of materially diminishing the combustibility of linen and cotton fabrics. Red-lead is found to be more advantageous in the manufacture of glass, than litharge, the reason of which is, that it contains a larger proportion of oxygen, the atomic numbers of these oxides being—

Litharge.

Lead.....	104	112
Oxygen.....	8	

Red-lead.

Lead.....	104	116
Oxygen.....	12	

Hence, in the case of litharge, if the volatilized carbonaceous matter evolved in the combustion of the fuel in the furnace should combine with any of its oxygen, its equivalent of lead would be revived in the metallic form, to the great deterioration of the glass; but in the case of red-lead, oxygen to the extent of one-third may be so dissipated, and the metal in the state of an oxide still remain. From this circumstance, is seen the utility of giving the crucible a dome-like covering, to protect its contents from the flame. The difference of density in flint glass is remarkable; the specific gravity of water being 1.00, that of glass from the top of the crucible will be 3.21, whilst from the bottom it will be 4.75. The Lecturer, in conclusion, alluded to and experimented on, those curious properties of unannealed glass, which are too well known to require any remarks.

EXPLOSION OF THE BOILER OF THE "ARCHIMEDES" STEAMER.

On Thursday afternoon, the 30th ult., the boiler of the *Archimedes* steamer, the vessel built for the purpose of testing the efficacy of Mr. Smith's patent screw propeller, exploded just as the vessel was about to get under weigh. The second engineer, of the name of M'Millan, was scalded to death, and another man of the name of Frazer very severely injured. An inquest was held upon the unfortunate deceased on Tuesday and Wednesday last, at which the coroner returned a verdict of "accidental death," and levied a deodand of 250*l.* on the boilers. The evidence of Mr. Field (of the firm of Maudslay and Field) gives a succinct account of the cause of the explosion. We therefore append it:—

"Mr. Field stated that he was not connected with the company to which the *Archimedes* belonged, but had been requested to make an inspection of the boiler of that vessel. He found the boiler was of the ordinary low pressure kind, generally used by steam-vessels upon the river. Its power and strength of plate were quite sufficient. The boiler was rather large. The great objection to it was, that it was less tied together than smaller boilers would be, and therefore subject to be sooner damaged. If he had had to make a similar boiler, he should have put more stays in it. The top of the boiler had been lifted by the pressure of the steam, the crown of it had been distorted, and by that means the safety-valve had been stopped from acting, and the spindle jammed, which prevented them from acting, to which cause he attributed the accident. He did not see any steam-gauges when he made the inspection; unless, therefore, the safety-valves acted, the pressure of the steam could not

be known. A good engineer might have known from the opening of the cocks, but every man could not. The top of the boiler had been lifted, but the chimney had not been moved from the place where it stood, in consequence of being attached to the flues. The engineers, in consequence of the jamming, were not able to know the strength of the steam, and that was the reason of the accident. When he made the examination he tested the valves, and found one of them loaded to the extent of 5¼, and the other to 6¼; that was rather higher than he should load them, but many would load them in that way. The pressure ought not to be increased, as it would be attended with danger to the safety of the boiler. There was nothing but the ordinary weight on the valves at the time he saw them. The tightest of the valves could be got at from the deck, and the other from below. A preventive to this occurrence would have been stronger staying or less pressure, but that would not have prevented it if the safety-valve had been jammed, which could not have taken place unless the boiler had been thrown out of shape. The boiler, if it had been sufficiently tied so as to prevent its altering its shape, would have been of sufficient strength to work up to 5¼. The thickness of the plates was quite sufficient. There were a great number of fires for so small a boiler, but they did not increase the danger at all. He should not have chosen to work a steam-vessel from London to Portsmouth without a steam gauge. If there had been a steam gauge in the present instance, it would have indicated danger—that there was something more than the ordinary pressure: the difference from an extra weight of 44lb. on one valve would increase the pressure 1½lb. or 1½lb. upon the square inch. He would have been extremely timid in loading the boiler to that extent. He thought the boilers were not sufficiently strong to bear the pressure he found upon them. If the boiler had been well tied and bound, however, it would have been of sufficient strength."

AMERICAN CONVENTION OF CIVIL ENGINEERS.

The American Civil Engineers, after various preliminary meetings have resolved to form a Society, similar in its objects to the London Institution of Civil Engineers. The Franklin Institute of Philadelphia have afforded them the benefit of co-operation; the head quarters of the convention are appointed to be at this Institution—and the Franklin Journal their organ. Mr. Benjamin H. Latrobe of Maryland, was elected President. We subjoin an extract from the address that has been circulated:—

"Public works are now so extended in our country, and the mass of experimental knowledge to be gained from those in use is so great and so peculiarly applicable to our circumstances, that it is even more valuable to the American engineer than what he can learn in Europe, where larger means have permitted greater expenditures. In this country it is of paramount importance to obtain the greatest amount of useful effect at the smallest cost; and of attempts to attain this end, the Union now contains a multitude of instructive examples. Some have been eminently successful, and others less so; but of either kind, the student, or the more advanced engineer, too often seeks in vain for any satisfactory written or printed description, and is unable to obtain any thing more than vague, doubtful and incorrect information. This evil can only be removed by the exertions of the engineers themselves.

"They are now established as a distinct class, and have long felt the want of such an association as that proposed, but it has hitherto been supposed that the proper time for its organization had not yet arrived.

"The success that has attended the labours of the London Institution of Civil Engineers, its high standing and great usefulness prove that such societies may be of great public utility, when properly conducted, and are incentives to induce us to imitate so excellent an example. It is admitted, however, that a society in this country must differ somewhat in its plan of operations from the British Institution, which can readily give utterance to its opinions elicited after frequent and full discussion, since a large portion of its members during the winter have their residences within the limits of London. Here, however, owing to the vast extent of territory over which are scattered the members of our profession, the usefulness of the society must (for the present at least) depend more upon the facts and experience of its members, made known in written communications, than upon their opinions orally expressed in public discussions.

"The very fact that our improvements are so widely spread, that few, if any members are able to give even the most important of them a personal examination, affords, perhaps, the strongest argument in favour of a society that shall, by a concert of action, bring the experience of the whole country within the reach of each member.

"The difficulty of meeting at any one point, caused by the time and expense required in travelling from distant portions of so extensive a country as the United State

is a serious obstacle, but it has been much diminished by the facilities afforded by the railroads already in use, which are among the valuable results of the labours of our civil engineers. Though our society may be less favourably situated than the one in London for frequent and public discussion, we nevertheless anticipate many important advantages to be derived from a personal intercourse and interchange of information among its members, and from the establishment of a permanent repository of the results of experience, obtained from the most authentic sources. The standing of the profession in our country is, fortunately, such, that its importance need not be dilated upon; it is, therefore, the more necessary that everything in the power of the members should be done to add to its respectability and increase its usefulness. We look forward to the formation of the society as a valuable means of advancing these desirable ends.

"We trust, also, that each may appreciate the importance of attending at the time and place appointed for forming the society, and will be willing to make some sacrifice for effecting that object; or if prevented from attending by uncontrollable circumstances, that he will express his views in writing upon the subject of a suitable constitution."

MANUFACTURE OF LEAD PENCILS.

The best black-lead pencils of this country are formed of slender parallelopipeds, cut out by a saw from sound pieces of plumbago, which have been previously calcined in close vessels at a bright red heat. These parallelopipeds are generally enclosed in cases made of cedar wood, though of late years they are also used alone, in peculiar pencil cases, under the name of ever-pointed pencils, provided with an iron wire and screw, to protrude a minute portion of the plumbago beyond the tubular metallic case, in proportion as it is wanted.

In the year 1795, M. Conté, a French gentleman, well acquainted with the mechanical arts, invented an ingenious process for making artificial black-lead pencils of superior quality, by which he and his successor and son-in-law, M. Humblot, have realized large fortunes.

Pure clay, or clay containing the smallest proportion of calcareous or siliceous matter, is the substance which he employed to give aggregation and solidity, not only to plumbago dust, but to all sorts of coloured powders. That earth has the property of diminishing in bulk, and increasing in hardness, in exact proportion to the degree of heat it is exposed to, and hence may be made to give every degree of solidity to crayons. The clay is prepared by diffusing it in large tubs through clear river water, and letting the thin mixture settle for two minutes. The supernatant milky liquor is drawn off by a syphon from near the surface, so that only the finest particles of clay are transferred into the second tub, upon a lower level. The sediment which falls very slowly in this tub, is extremely soft and plastic. The clear water being run off, the deposit is placed upon a linen filter, and allowed to dry. It is now ready for use.

The plumbago must be reduced to a fine powder in an iron mortar, then put into a crucible, and calcined at a heat approaching to whiteness. The action of the fire gives it a brilliancy and softness which it would not otherwise possess, and prevents it from being affected by the clay, which it is apt to be in its natural state. The less clay is mixed with the plumbago, and the less the mixture is calcined, the softer are the pencils made of it; the more clay is used the harder are the pencils. Some of the best pencils made by M. Conté, were formed of two parts of plumbago and three parts of clay; others of equal parts. This composition admits of indefinite variations, both as to the shade and hardness; advantages not possessed by the native mineral. While the traces may be made as black as those of pure plumbago, they have not that glistening aspect which often impairs the beauty of black-lead drawings. The same lustre may, however, be obtained by increasing the proportion of powdered plumbago relatively to the clay.

The materials having been carefully sifted, a little of the clay is to be mixed with the plumbago, and the mixture is to be triturated with water into a perfectly uniform paste. A portion of this paste may be tested by calcination. If on cutting the indurated mass, particles of plumbago appear, the whole must be further levigated. The remainder of the clay is now to be introduced, and the paste is to be ground with a muller upon a porphyry slab, till it be quite homogeneous, and of the consistence of thin dough. It is now to be made into a ball, put upon a support, and placed under a bell glass inverted in a basin of water, so as to be exposed merely to the moist air.

Small grooves are to be made in a smooth board, similar to the pencil parallelopipeds, but a little longer and wider, to allow for the contraction of volume. The wood must be boiled in grease, to prevent the paste from sticking to it. The above described paste being pressed with a spatula into these grooves, another board, also boiled in grease, is to be laid over them very closely, and secured by means of screw-clamps. As the

atmospheric air can get access only to the ends of the grooves, the ends of the pencil pieces become dry first, and by their contraction in volume get loose in the grooves, allowing the air to insinuate further and to dry the remainder of the paste in succession. When the whole piece is dried, it becomes loose, and might be turned out of the grooves. But before this is done, the mole must be put into an oven moderately heated, in order to render the pencil pieces still drier. The mould should now be taken out, and emptied upon a table covered with cloth. The greater part of the pieces will be entire, and only a few will have been broken, if the above precautions have been duly observed. They are all, however, perfectly straight, which is a matter of the first importance.

In order to give solidity to these pencils, they must be set upright in a crucible till it is filled with them, and then surrounded with charcoal powder, fine sand, or sifted wood ashes. The crucible, after having a luted cover applied, is to be put into a furnace, and exposed to a degree of heat regulated by the pyrometer of Wedgewood; which degree is proportional to the intended hardness of the pencils. When they have been thus baked, the crucible is to be removed from the fire, and allowed to cool with the pencils in it.

Should the pencils be intended for drawing architectural plans, or for very fine lines, they must be immersed in melted wax or suet nearly boiling hot, before they are put into the cedar cases. This immersion is best done by heating the pencils first upon a gridiron, and then plunging them into the melted wax or tallow. They acquire by this means a certain degree of softness, are less apt to be abraded by use, and preserve their points much better.

When these pencils are intended to draw ornamental subjects with much shading, they should not be dipped as above.

Second process for making artificial pencils, somewhat different from the preceding.—All the operations are the same, except that some lamp-black is introduced along with the plumbago powder and the clay. In calcining these pencils in the crucible, the contact of air must be carefully excluded, to prevent the lamp-black from being burned away on the surface. An indefinite variety of pencils, of every possible black tint, may thus be produced, admirably adapted to draw from nature.

Another ingenious form of mould is the following:

Models of the pencil-pieces *must be made* in iron, *and stuck upright upon an iron tray, having edges raised as high as the intended length of the pencils.* A metallic alloy is made of tin, lead, bismuth and antimony, which melts at a moderate heat. This is poured into the sheet-iron tray, and after it is cooled and concreted, it is inverted, and shaken off from the model bars, so as to form a mass of metal perforated throughout with tubular cavities, corresponding to the intended pencil-pieces. The paste is introduced by pressure into these cavities, and set aside to dry slowly. When nearly dry, the pieces get so much shrunk that they may be readily turned out of the moulds upon a cloth table. They are then to be completely desiccated in the shade, afterwards in a stove-room, next in the oven, and lastly ignited in the crucible, with the precautions above prescribed.

M. Conté recommends the hardest pencils of the architect to be made of lead melted with some antimony and a little quicksilver.

In their further researches upon this subject, M. Conté and M. Humblot found that the different degrees of hardness of crayons could not be obtained in a uniform manner by the mere mixture of plumbago and clay in determinate doses. But they discovered a remedy for this defect in the use of saline solutions, more or less concentrated, into which they plunged the pencils, in order to modify their hardness, and increase the uniformity of their texture. The non-deliquescent sulphates were preferred for this purpose: such as sulphate of soda, &c. Even syrup was found useful in this way.—*Dr. Ure's Dict.*

LIST OF IRISH PATENTS GRANTED IN APRIL, 1839.

M. Balmanno, for a new and improved method of making and manufacturing paper, pasteboard, felt, and tissues. April 4.

Richard Roberts, for an improvement or certain improvements of, in, or applicable to, the mole, billy, jenny, stretching frame, or any other machine or machines, however designated or named, used in spinning cotton, wool, or other fibrous substances, and in which either spindles recede from and approach the rollers or other deliverers of the said fibrous substances, or in which such rollers or deliverers recede from and approach the spindles. April 9.

Moses Poole, for improvements in apparatus or machinery for obtaining rotatory motion. April 15.

John Small, for improvements in the manufactures of threads or yarn, and paper, by the application of certain fibrous materials not hitherto so employed. April 17.

Peter Taylor, for improvements in machinery for propelling vessels, carriages, and machinery, part of which improvements are applicable to the raising of water. April 19.

John Boyd and H. F. Pennie, for certain improvements upon the spinning frame, for spinning flax, hemp, and tow, upon the wet principle. April 19.

H. H. Mohun, for improvements in apparatus for producing light and heat. April 24.

Edward Harper, for certain improvements in the apparatus for grinding corn or bran by application of steam, water, and other power, in order to economize fuel and expense in such progress. April 26.

Samuel Clegg, for a new improvement in valve

and the combination of them with machinery. April 26.

William Hale, for improvements in steam-engines and apparatus connected therewith, and in machinery for propelling vessels. April 26.

NOTES AND NOTICES.

The Bude light in the House of Commons.—The experiments of the Bude lights for lighting the House of Commons were lately tried, chiefly with the view of ascertaining the effect of the new plan upon the reporters' gallery. As far as that part of the house was concerned, we can say the trial was altogether successful. Though the apparatus for conveying the light to that as well as to other parts of the house is not yet complete, yet enough of its operation was seen to show, that when complete, its superiority over the wax lights will be past all question. We understand that on the first trial the complaint was general that the glare thrown into the body of the house was greatly offensive to the eye, while the seats under the gallery were in comparative obscurity; the grounds of this objection have now been wholly removed. The light is now made to descend from the roof through ground glass plates, over which the apparatus is so contrived that the light can with ease be varied from the colour of a pale moonlight to a bright sunlight, or be mellowed down to a rich autumnal glow; still giving sufficient light, without any unpleasant glare, to every part of the house. The glass through which the light is sent down is fitted air-tight into the bottom of the chandelier, so that no heat can be generated by it in the house, save the slight radiation from the surface of the chandelier itself, but compared with the heat and the consumption of atmospheric air by the combustion (or rather the very imperfect combustion) of 240 wax candles, the heat and atmospheric combustion of the new plan are not (as far as the body of the house is concerned) as 1 to 100. Whatever heat may be generated by the new process will be carried off through the roof, and never affect the body of the house. To those of our readers who may not be acquainted with the nature of what is called the "Bude" light, it will suffice to say, that in Mr. Gurney's plan it consists in a number of burners (in each chandelier) supplied with wick and oil, somewhat like the Argand lamp, with the improvement that in this there is only one circle or cylinder, while in the common Argand lamp there are two. Lighted in this state, the lamp would send off a very large and offensive mass of unconsumed carbon; but to prevent this, a stream of oxygen gas is made to pass through the centre of each burner, by which the total combustion of the carbon of the oil and wick takes place, and the light is consequently raised to a beautifully brilliant flame, the intensity of which may be increased according to the volume of the stream of oxygen passed through it, and, as we have already said, the light may be mellowed as taste, fancy, or convenience may suggest. From what we saw last night we think the very clever plan of Mr. Gurney a vast improvement on the present system, and, as Joe Hume would say, "it is a great deal cheaper."—*Times.*

The Paris Exhibition of Manufactures.—"*Apropos* of the unmeasured raptures of the press on the occasion. If the artists and manufacturers of France are so superior to those of every other land, why not abolish those fiscal restrictions that exclude the manufactures of foreign countries? What danger, for instance, can there be in admitting English manufacturers to a fair competition, if those of France are so superior? The truth is, there is a good deal of empty swaggering in all this talk. The panegyrists set forth as novel inventions, things that were known and familiar to our English grandsires. Still there are many things which strike me as improvements, particularly in clock, watch, and lamp making: there are articles of bronze, moulded with extreme delicacy, and various machines that might stand a comparison with those of the best English founderies."—*Athenæum.*

D'Harcourt's Patent Artificial Granite Blocks.—The attention of a meeting of the Institute of Civil Engineers having been called to M. D'Harcourt's artificial granite for railway blocks, and other purposes, Mr. Rastrick remarked that he had, about a month ago, laid down blocks of the Scotch Asphalte, two feet square, on a portion of the Southampton Railway. The sleeper was put in while the block was formed. It was usual to bore holes and to fix the chairs by bolts; he had wished to ascertain how far the blocks would stand the driving in of the bolts, without any boring; they bore this without any apparent injury, and he thought these blocks, weighing about 3¾ cwt., would answer the purpose better than blocks of other materials.

British Association.—The Model Committee, appointed to superintend the exhibition of models at the meeting of the British Association for the Advancement of Science, to be held in this town on the 26th of August next, are desirous of receiving specimens of manufacture and works of art, by the 15th of that month, in order that they may be properly arranged and classified.—*Birmingham Advertiser.*

Society for the Protection of Life from Fire.—The third annual meeting of this society was held on Thursday last, at Freemason's Hall, Great Queen-street, Lord Teignmouth in the chair. After reading a brief and unsatisfactory report from the Committee of Management, its adoption was moved and seconded, and was about to be put by the Chairman, when a gentleman rose to move an amendment. Lord Teignmouth denounced such an interruption, stating, that he must proceed with the business of the meeting agreeably to the order prescribed by the paper before him. Upon this, several highly respectable gentlemen, early and zealous supporters of the society, got up, and insisted on being heard; declaring that they wanted but justice, and justice they would have. The noble Chairman finding the meeting in no way disposed to support him in his injudicious determination to cram the obnoxious report down their throats, *sans discussion*, threatened to leave the chair if the opposition was persisted in; this he ultimately did, amidst the most unequivocal marks of disapprobation from the meeting. John Hardy, Esq., having been voted to the vacant chair, an animated discussion ensued, in which the proceedings of the directors were severely censured, and some very just remarks made upon the disgraceful ambiguity attempted to be thrown around the financial transactions of the society. Much good feeling, however, characterised the discussion, and ultimately matters were amicably arranged, by the appointment of a committee, to whom it was referred to enquire into the present condition of the society, and to amend "the report" with a view to its being brought before another public meeting about a month hence. It is a great pity that a society for such an excellent purpose, which has been so nobly patronised, and so liberally supported, should suffer from incompetence or want of respectability on the part of its officials. D.

The thirtieth Volume of the *Mechanics' Magazine* will be published on the 1st of July, illustrated with a splendid engraving of a LOCOMOTIVE ENGINE AND TENDER—the size of a sheet and a half of demy paper—exhibiting the whole of the machinery of the engine, and explaining its action.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough-court*, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

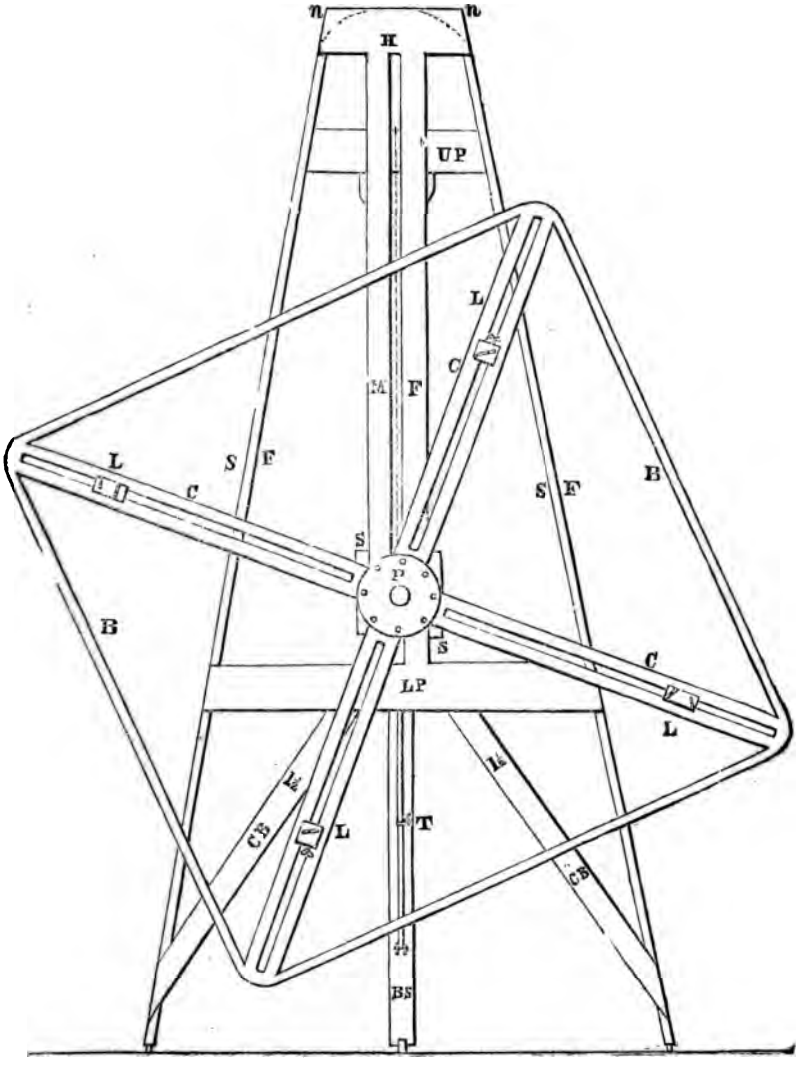
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 827.] SATURDAY, JUNE 15, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

REV. W. HORNER'S IMPROVED ARTIST'S EASEL.

Fig. 1.



REV. W. HORNER'S IMPROVED ARTIST'S EASEL.

Sir,—Having been a reader of your valuable publication from its first appearance to the present time, and not having seen in it any notice of an improved construction of the artist's easel, I think a sketch of one which I have found very convenient, may be acceptable to professional, as well as to amateur artists. The advantages of my easel are:—

1st, A sliding counterpoise on the back-stay of the frame, which is in the form of a long box loaded with cast-iron or lead weights, (each about 1lb.,) which may be added or taken off, according to the weight of the picture.

2d, Placing the frame on castors, which render its motion from one position to another, even when loaded with a heavy picture, smooth and easy, though firm when used.

3d, A cross frame, fixed on a strong central pin in a slide in the middle frame, furnished with clamps sliding in grooves, which secure the painting so as to prevent the possibility of accident, even if it should hang forward a little beyond the perpendicular; the sliding weight placing the centre of gravity far within the surface of the picture, especially when the weight traverses, as it ought to do, as near as possible to the bottom of the back-stay.

This construction is applicable to an easel of any size. I have two: one of the dimensions given in the engraving (about 7 feet high), which is adapted to a picture 6 feet square, and another which may rest on a table, and takes one of about 20 inches.

The cross, carrying the picture, may be turned round with a finger in any direction, but yet is firm enough to resist any motion from the mere action of the pencil or brush.

Description.—Fig. 1. The frame consists of four upright and three cross pieces. S. F., the side-frame, is placed edgeways to the plane of the front, in order to combine strength with as little friction as possible, in the sliding of the cross up and down, or in turning on the central pin. The pieces are 3½ inches wide, by 1 inch thick. To prevent the cross *catching the head H. in* turning round, *the corners n n, must be gradually* shaved *off,* [illegible] *ed by the dotted* lines; ¼ of an inch at the corner will be sufficient. M. F., the middle frame, consists of two pieces parallel, and 1 inch asunder, between which the centre division of the slide moves; the whole slide, as well as the inner surface of the cross on which it accurately bears, is in the same plane as the middle and side frames. The side view, fig. 2, explains this. The centre P of the cross, is strengthened by a strong tinned or brass plate joined into it, through which the pin (having a conical head, and square body, tapped at the inner end with a circular nut) passes. See section, fig. 3. By tightening this nut the cross is stiffened in its movement, or altogether.

S. S., the slide, of which fig. 3 is the section.

T., a brass tube, having another sliding inside with a thumb screw to alter the angle between the middle frame and back-stay, being fixed to L. P. and B. S.

W., The case containing the balancing weights, having a projection to prevent the weights falling out, as in fig. 7, of which W. is a cross section of the case, and W′ the weight taken out of it.

This case might be advantageously made of cast-iron or brass, exactly, (when empty), balancing the cross and slide. The case W. is attached to the slide by a very strong and sound piece of catgut, such as is used for turning lathes, which passes over a brass pulley in the upper cross piece. Both this case and the slide may, if necessary, move on friction rollers. Black lead, rubbed on straight grained Spanish mahogany (of which I would recommend the whole frame to be made), has with me answered very well; a weight of 4 or 5 lbs. being sufficient when well balanced to overcome the friction. The braces C. B. from L. P. into the foot of the side frame are shown wider than necessary in the drawing; 1½ in. is enough. I have tried several different kinds of clamp, of which fig. 4 is the most perfect, as the painting is not liable to be disturbed in its shape by pressure on the edge of the stretcher. L. L. L. L. are the clamps.

The lower sliding part F. is first fixed in its place by a small nut in the shape of a cross, which is turned by a key similar to that used in turning the piano forte. Its position is ascertained by measuring the length and breadth of the picture, and referring to figure

the cross, numbered in half inches from the centre to the extremity of each arm.

Fig. 3.

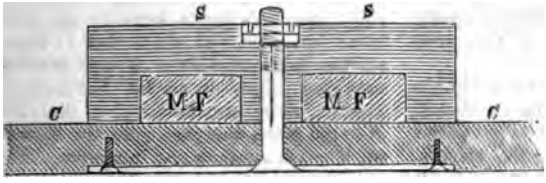
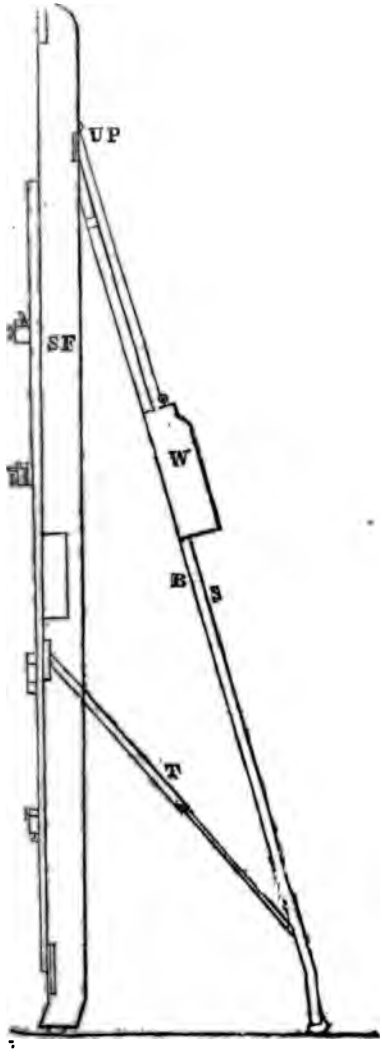


Fig. 2.



The face X of each clamp is fixed a very little outside the mark, and the cross

Fig. 5.

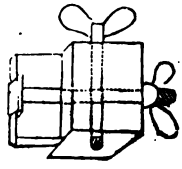


Fig. 4.

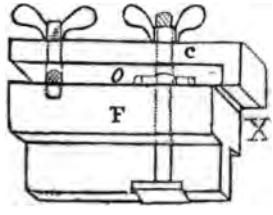


Fig. 8.

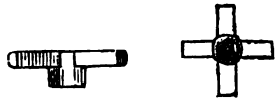


Fig. 6.

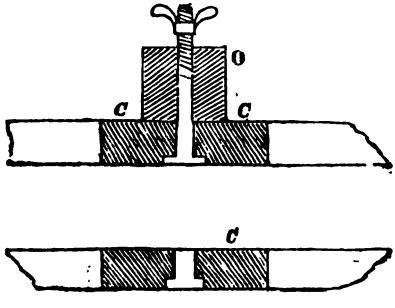
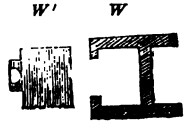


Fig. 7.



nut screwed home. The claw C. is then fixed by the upper nut of the same screw and the projecting face brought down upon the face of the picture. Its pres-

sure may be much increased by turning the screw A. which bears on the surface of the block F. My clamps are made of very hard beech, and the iron screw A. makes a thread for itself in the wood which hitherto has answered my purpose. Fig. 8. are separate views of the cross nut marked *o* in fig. 4.

Fig. 5 is a clamp with a mere simple screw, but it is attended with the disadvantage of pressing on the edge of the stretcher, and thus relaxing the canvas. However, it answers very well for a small picture.

I am, Sir, your constant reader,
W. HORNER.

Kirkdale, near Liverpool, April 15, 1839.

SOCIETY OF ARTS.—REMARKS ON ITS DISTRIBUTION OF REWARDS, ETC.

In another part of this week's number we publish a report of the proceedings at the annual meeting, for the distribution of the prizes awarded by the Society of Arts during the session of 1838-9. Coming so closely on the heels of our incidental animadversions upon the present state of the Society, we cannot let it pass without a few remarks—the more especially as we have received several communications from Members and others, some in defence of the Society, and some begging us to use our influence to obtain its complete remodelling, and to point out some more efficient method than is now adopted, of carrying out its "principal object," viz., to reward inventors. It is in the power of the members themselves, and of these only, to effect the desirable change; all we can do is to point out the evil—they must apply the remedy.

Turning, then, to the report of the annual distribution, we see continued reasons in it for dissatisfaction, on the part of the members who subscribe to the institution—of the public, who patronize it with their support and name—and of inventors, whom it was designed to encourage and assist. The Duke of Sussex made just such a neat speech as might be expected. His Highness, of course, could not but praise the Society of which he is president. His declaration, that the fewer the prizes the greater the honour conferred upon those who gained them, is true enough in the abstract; and if the few rewards had been of proportionately increased value, it might have been applicable in the present instance. His Royal Highness must certainly have felt vexed at the poor exhibition of British invention his Society made to the eyes of the Russian Prince, Menzikoff; but there is no fear of the illustrious stranger's forming an estimate by what he there saw: there are too many ingenious British mechanics and engineers in his Sovereign's pay, to allow him to imagine that the Adelphi prize-receivers were the flower of English artizans and inventors. He might certainly imagine that, like exporting countries, and localities noted for any particular commodity, we send the best articles away to market, and make shift for ourselves with the inferior!

Let us now see what are the characters and the merits of the inventions for which the prizes were given.

1. A mode of preparing photogenic drawing paper. Very good in its way, and would occupy a fair place amongst the many methods already published, all with little variations, in different journals; perhaps a judicious reward, being a new art, and no competing process offering.

2. A new mode of transferring copper-plate impressions to zinc and stone.—Known to most good lithographers.

3. A mode of lettering polished marble.—This is amongst the most useful of the rewarded inventions. The ordinary way of lettering monumental inscriptions, is to cut the letters roughly in the marble or stone, and the neatness or finish is given to them with black paint by the brush of the writer; thus when the paint is worn off, the letters appear coarse, jagged, and irregular. Mr. Page improves upon this by having the letters cut well with the chisel into the marble or stone; he then fills them with the black paint or varnish, and when this is dry, with a flat piece of brass he scrapes off the superfluous varnish from the surface of the marble, leaving the indented letters filled with it. The process is something similar to the inking of a copper-plate. There is no doubt but that better and more lasting lettering must be produced in this way, but the letter cutter will of course require better pay, because it will take more time and trouble to cut letters well, than to give a mere coarse outline to be finished by the painter. The only questionable point is, whether the common porous marble and stone will not absorb the

varnish on the surface that is intended to be scraped off, notwithstanding the protective coat of size and whiting used, and so leave a shade round the inscription.

4. An apparatus for the use of divers.—Ingenious, but its utility doubtful, and not likely to be tested.

5. A travelling platform.—This is a contrivance of a simple and ingenious kind which might be useful to he who from the dizzy height hangs

"ha'f way down
"—— and gathers samphire—dreadful trade."

to such adventurous architects as Mr. Billings, whom we have noticed in the report of the meeting, and who during the time he was examining the window of Carlisle Cathedral, was suspended by a rope 60 or 70 feet from the ground, the structure being too rotten to bear a ladder against it. The travelling platform consists of two boards 12 inches long by 4 wide, strongly hinged together; the joints of the hinges are uppermost, and a groove in the centre allows a strong rope to pass between the boards freely when they are brought into a horizontal position. Each board is to be strapped securely to the climber's foot; a belt also passes round his waist, having attached to it a ring through which the rope also passes. When a person thus equipped wishes to ascend the rope, he hangs by his hands, draws up his knees, keeping the hinged board in a flat position, and it slips up the rope: immediately his weight is put upon the boards the edges on the under side (the contrary to that on which the hinge joints are placed) collapse, and firmly clutch the rope, and he raises himself, his weight acting on the lever formed by the width of the board, its thickness, and the hinge joints. A workman may thus be supported in many situations where a ladder could not be conveniently used, without the fatigue of keeping the muscles of the legs in constant exertion clasping the rope, and with the facility of moving upwards or downwards without extraneous assistance

5. Mr. Jennings's night signals for steamers, consisting of coloured lamps on the ends of telegraph arms. This would be useful if generally acknowledged and known by all steam-boat captains and pilots—but as there are several of a *somewhat similar nature already in use—the attempt to introduce* a new code of signals, except under the highest, and, we may add, compulsory authority, would only create confusion, and lead to disastrous results.

7 and 8. Scale lever, and spring bolt plate—ingenious trifles—which *may* be useful.

9. Mr. Gray's instruments for extracting teeth are ingenious, but all founded upon a mode of action now abandoned by the best dentists—that of making a fulcrum of the adjoining tooth to raise the doomed one. We much question whether any dentist would or could use some of Mr. Gray's instruments, or even that he uses them himself in ordinary cases, or some of them, ever.

10. Without intending to disparage the ingenuity of Mr. Wivell's fire-escape, we must observe that it was without the pale of the Society's regulations as to rewards—in the first place, because it had been previously fully described and published in the *Mechanics' Magazine*, and, in the second place, because it had been the subject of a reward from another society—the Society for the Protection of Life from Fire.

11. The method of determining the lengths and bevels of timbers in a hip roof we shall not pretend to give an opinion upon. Its action depends upon calculations, into the correctness of which, the committee to which it was referred, doubtless examined.

12, 13 and 14, three silk velvet weavers rewarded for their shares in one invention, that of a mode of weaving wide velvet, and which we noticed at the time it was examined by the Committee. (See No. 810,) appears to us to be almost the only improvement of genuine utility on the Society's list for 1838-9, and which comes within the legitimate application of its funds. We should have liked to have seen the rewards of ten times the amount.

15. Our last remarks partly apply to this machine for weaving silk tissue.

The rewards numbered 16 to 34 are to amateurs and artists for drawings and paintings, which are beyond the reach of our criticism, with the exception of the last, which we have elsewhere noticed, viz. that of Mr. Billings.

Thus, as regards the rewards in the department of useful arts, we have made a full display of all the talent the Society

could draw out; and to what does it amount? Do the members really think that their subscriptions (amounting to between one and two thousand pounds—but of this we are in the dark, no allusion being made to finances in the report) have been applied to good purposes? It may be said, that there are other ways in which the funds are expended; and this is, doubtless, the case,—keeping, however, in view the declared "*principal* object"—we ask is about a tithe of the income, to be considered as a fair proportion to be applied thereto? But what are these other objects to which the bulk of the funds are applied? The library consists almost solely of books *given* to the Society; and there is what is called an "Illustration"—once a month for six months in the year—a skeleton of a lecture, for the time to which the Illustration is limited, will not allow of filling up; and then there is the printing of the *Transactions*. All these in the year 1837-8, amounted to less than £400; the difference between which sum and £1952 is expended in salaries, rent and taxes, and incidental expenses. Is this large executive expense necessary to carry out the objects of the Society?

Having now pointed out the prominent faults of the Society, we leave it to the members to effect the desired alteration. The Society acknowledges its decline, and yet looks wondering abroad for the cause, whilst the cause lies at home. We hope to see the next session commenced in a new spirit—with published offers of rewards of value; a few hundred-guinea prizes would bring out some of the dormant talent of our mechanics, which cannot be roused by the crumple of a five pound note, the glare of a silver medal, or the patronizing tones of a Royal Duke.

Why should not the "Illustrations" be weekly, or even twice a week—and all the year round? A month's dust should not be allowed to collect on so handsome a lecture room as the Society possesses. The museum too, might be applied to better purpose: it is palling to the mind to have continually presented to the eyes the same *old* new inventions—meritorious enough no doubt at the time of their invention, but more fitting for the museum of a mechanical *Antiquarian Society, than for* that of one which professes to reward and encourage novelty.

We have heard that Mr. Aiken, the talented Secretary of the Institution has resigned, or is about to resign, in consequence of ill health. He will retire with the good wishes and respect of all who have ever visited or been connected with the Society to which his scientific acquirements did honour. His essays have long been the main, and perhaps most valuable feature in the volumes of the *Transactions*.

THAMES AND CLYDE-BUILT STEAM-VESSELS AND ENGINES — THE "BRITISH QUEEN."

Sir,—The recent letters of "Caledonia" and "Bowsprit" in Nos. 822 and 823 of your miscellany, and of "Observator" in No. 824, are very amusing as illustrative of the feelings and opinions of the various parties whom they represent. "Caledonia" would fain have us believe that the requisite talent for building and equipping steamers is only to be found north of the Tweed, and then only in the Clyde.

That the original plan of the joiner's work or cabins of the "*British Queen*" was faulty is undoubtedly true—but that it was because southern artificers were employed, does not follow, for it may have happened that northern talent was employed to design it—at all events, a Scotchman has the credit of it, whether justly or not, I will not presume to say. It appeared to me (let it have been designed by whomsoever it might) that the contriver endeavoured to stow as many persons as the space would admit, on the same principle as slavers are fitted up, without the least regard to their comfort or convenience.

With regard to the machinery, whilst I have no doubt as to the skill and care which Mr. Napier has displayed in the design and execution of the engines, yet it does sound somewhat strange, that it was not until the *Queen* arrived in the Clyde, "that it was found that she could not safely be taken to Glasgow, where Mr. Napier has every convenience for hoisting in the machinery," &c.

The *British Queen* was, if I mistake not, in a forward state before the arrangements were entered into with Mr. Napier, for putting in the machinery;

her size and length were well known, and her probable draft was calculated within a few inches: on this point, therefore, I think that "Caledonia" must be under some misapprehension; as also in his subsequent statement, that the London shipwrights had not allowed sufficient height for the engines. The hull being nearly completed before Mr. Napier commenced making the engines, the London shipwrights could scarcely be the authors of the blunder. It is right that your readers should be aware, that in the building of such vessels in London, the shipwright prepares and works to correct plans, copies of which are furnished to the engineers for their guidance as to the space and dimensions of the engine-room. By whom the plans were furnished to Mr. Napier, I know not, but from what I know of that gentleman, I feel assured that he would work to plans furnished him, and if so, he at least is blameless in this affair. "Caledonia's" remarks about the workmanship of the London builders, and the superiority of those in the North are notoriously the reverse of the truth, as is well known to all who are the least conversant in maritime affairs, and were it proper, a vast number of instances might be adduced in proof of the correctness of my statement. It would be well for "Caledonia" to make himself better acquainted with the facts before he again ventures to puff off Scotch expedition in the outfit of steamers. The case of the *British Queen* is, perhaps a singular one. The Scotch Engineers who had contracted to make her engines became bankrupt when the vessel was just on the eve of completion; arrangements were then entered into with Mr. Napier to supply them, who, as I am informed, had to commence *de novo*, and therefore must be held blameless for the delay which has taken place in her outfit. Whether the British and North American Steam Navigation Company have been gainers by refusing the offers first made them by London engineers is very doubtful, the general impression is, that their gain will prove a heavy loss to them.

"Bowsprit" has answered "Caledonia's" remarks *stem on* by his reference to the *Great Western*—into which ship Messrs. Maudsley put engines of nearly equal size *and real power, at* a distance from their manufactory in a very short space of time, and thus gave to her owners the advantage of running her to New York nearly two seasons before the *British Queen* is ready.

The remarks of "S." in No. 824, on the defective and weak methods of building steam boats, are entitled to the serious attention of all interested in steam navigation. Instead of fir planking on timbers 6 inches square for steam vessels of 1,000 tons, materials of the best quality and of sufficient size ought to be employed, and combined in the most secure methods.

"Observator" in No. 824, has called the attention of your reader to a new competitor in steam navigation. The French boats, *Castor* and *Pollux*, are now running between London and St. Vallery sur Somme, propelled by English engines. It is time for British ship builders to bestir themselves, and adopt a better model than they have hitherto used for their sea-going steamers, and I have no doubt, but that they will prove themselves as superior to the French, in point of model, as they now are in machinery.

I am, Sir, yours respectfully,

GEORGE BAYLEY.

June 6, 1839.

P.S.—The general weakness of merchant steamers is most distinctly shown by the wrinkling of the copper and the alteration of the sheer which takes place; there is scarcely a steamer of two years old, that is free from these indications of weakness, certainly there is not a Scotch built steamer that has come under my notice during the last five years that is free from them. If our Scotch friends would puff their work less, and perform more, it would be more creditable to them.

FRENCH BOASTING QUIETED.—THE "CASTOR" BEATEN BY THE "SIRIUS."

Sir,—A correspondent in one of your late numbers will be glad to learn of the fact, that the *Castor* French steamer is not the fastest in the world. I yesterday took the *Sirius* down to Gravesend on her passage to St. Petersburgh. The *Castor* had the start of us, but we speedily overhauled and arrived some time in Gravesend before her. So much

for the braggadocio of her proprietors in stating she could beat any sea-going steamer in the world.

Sir, your obedient servant,
J. Voss, Pilot.

June 6, 1839.

N. B.—The *Sirius* was the vessel that first went to New York propelled by steam.

THE LONDON FIRE BRIGADE.—MR. BADDELEY *very* BRIEFLY ANSWERED.

Sir,—Notwithstanding the *impartial* editorial note to Mr. Baddeley's last, I trust you will find a corner for a reply of a dozen lines—all that are necessary.

I willingly leave the question in the hands of your readers, if question there be, after Mr. Baddeley has, by his studied silence as to the proofs furnished at his own calls, pleaded guilty to the two most material points: 1. *His own glaring inconsistency;* 2. *The inadequate protection afforded to the public by the Insurance Companies.*

With respect to the motives for writing anonymously, I fear Mr. B. must have drawn his opinions from his own practice in that line; assuredly not from that of, Mr. Editor,

Yours respectfully,
AQUARIUS.

London, 7th June, 1839.

CLEGG'S PNEUMATIC RAILWAY.

We lately published amongst our "Notes and Notices" a brief account of some experiments by Mr. Clegg upon the plan which Mr. Vallance and Mr. Pinkus had failed to render effective (the latter, too, with the large means of a company at his command.) We extract the following statement from a pamphlet lately published upon the subject, by Mr. Clegg. We do not see anything sufficiently novel or important in Mr. C.'s mode of proceeding, to call for any particular remark, or to lead us to change the opinion we have frequently expressed upon the feasibility of the scheme:—

"Clegg's atmospheric railroad is worked by stationary steam-engines, apart from each other two to five miles, according to the nature of the country. Two engines are fixed at each station, one for the up and the other *for the down main, excepting* on long inclined planes, where one engine only is required at the same points.

"The power of these engines varies according to the gradients and traffic. Supposing the traffic to be 2500 tons per day, say 1250 tons each way, and the velocity required to be thirty-five miles per hour, the average power employed on the line would be equal to six-horse per mile. The size of the engines will vary from six to twenty-five horse-power, according to the gradients. The power is communicated to the train by means of a main or pipe laid between the rails, which is exhausted by air-pumps worked by the engines. This pipe is divided into lengths or sections (varying according to the respective distance of the engines) by valves, which are opened by the train as it goes along; and a space is left between each section, with proper sidings for stopping the trains when necessary. The pipe suited to the above-mentioned traffic would be ten inches in diameter. A piston is fitted to the pipe in such a manner that it will slide air-tightly therein. The pressure on the back of this piston (when the pipe is exhausted to the degree required for the steepest ascents) will produce a vacuum equal to a column of mercury twenty inches high.

"An available tractive force is thus obtained of 714 lbs, which will draw a train weighing thirteen tons up an ascent of one in fifty. With engines of the before-named power, the train can be impelled at the rate of thirty-five miles per hour, and the sections of the pipe exhausted with sufficient rapidity to admit of a train being dispatched each way every ten minutes; or, if we make allowance for all possible delay, four trains each way may be transmitted per hour, making a total of 2496 tons per day.

"To the first or driving carriage of the train an arm from the piston is attached. This arm passes through an opening about an inch and a half wide, extending the whole length of the pipe on its upper surface; and this opening is covered by a valve, the nature of which constitutes the peculiarity of Mr. Clegg's system; and is, by a simple and efficacious contrivance, rendered absolutely air-tight. The construction and action of this valve cannot be clearly explained without reference to diagrams or models, but the following account of experiments made by Messrs. Samuda, at Southwark Iron-works, will be sufficient to prove its efficacy:—

"The first of these experiments was made with a pipe three and five-eighth inches diameter, and thirty feet in length, which was laid level, and was exhausted by an air-pump of twelve inches diameter, worked by

four men. Although the joints were but roughly and imperfectly made, a vacuum was attained when both ends of the pipe were plugged, equal to a column of twenty-five inches of mercury, and but little less when the piston was in the pipes. This piston raised eighty-four pounds weight perpendicularly over a pully, besides drawing a carriage on the railway, which weighed 160 lbs.

"The next trial was made on an ascent of one in thirty, with the same pipe, but increased in length to 102 feet, and exhausted by the same air-pump, which was on this occasion attached to the steam-engine at the works. A cock was also placed close to the pipes, to separate them from the pump, when required for the purpose of better ascertaining the leakage in the pipe itself. A vacuum gauge was attached to each end of the pipe, to ascertain the time that would be required to obtain an equal vacuum throughout its whole length. On this occasion the carriages, which were loaded with iron, weighed *twenty hundred weight*, and were drawn up with great ease. The vacuum at both ends of the pipe was obtained at the same moment of time, and the two gauges rose and fell simultaneously. In order to ascertain the real leakage in the pipe and continuous valve, the ends of the pipe were plugged, when the vacuum gauge rose to twenty-seven and three-fourth inches of mercury. The cock was then shut, and the mercury was six minutes in descending, showing a leakage in 102 feet length of pipe of only three-fourths of a cubic foot per minute

"The main pipe is put together with deep socket joints, in each of which an annular space is left about the middle of the packing, which is filled with a fluid, and thus any possible leakage of air into the pipe is prevented. Should the fluid pass through the packing, a circumstance very unlikely to occur, it can be easily replenished.

"A receiver is attached to each steam-engine, having an internal capacity as large as the section of pipe which the engine has to exhaust. This receiver is exhausted by the air-pump when the train piston is not in the pipe, so that the engines are constantly at work, after one train has passed generating power for the next. The pipe itself is also exhausted in the interval between the exit of one train and the entrance of another. No pipe is laid on a descending plane, except where that descent occurs in the middle of a section, in which case the pipe has no valve or lateral opening, and is laid below the surface. Whenever a train has passed out of a section of pipe, the pump is employed, first, to exhaust the receiver to the greatest possible degree, and then to exhaust the pipe to the degree required for the train."

OBSERVATIONS ON THE CIRCUMSTANCES ATTENDING THE EXPLOSION AND BURSTING OF STEAM BOILERS; WITH ANIMADVERSIONS ON THE EXPERIMENTS OF THE FRANKLIN INSTITUTE ON THAT SUBJECT. BY JACOB PERKINS, CIVIL ENGINEER.

[From the *F. anklin Journal.*]

A series of experiments to discover the cause of the explosions of steam boilers, was ordered to be made, by the Secretary of the Treasury, of the United States of America, and the Franklin Institute was selected to make the experiments, and certainly no pains have been spared by that Institution in its researches; but from the want of some practical facts which have transpired in the course of the experiments which I have made within the last twelve years, they have, as I believe, arrived at some conclusions entirely fallacious, and which will, if not controverted, tend to injurious consequences. The most dangerous of these conclusions is, that all the destructive explosions of steam boilers have been caused by the direct pressure of the steam, and that there is no difference between the explosion and the bursting of a steam boiler. If the late Oliver Evans (who in his own department was one of the greatest men America has ever produced) had been still living, he would have given a very different opinion. Mr. Evans had a record of more than 600 burstings, before he had one explosion, although the pressure was greater when the bursting took place than when the explosion happened. I have myself witnessed enough to be perfectly satisfied that there is as much difference between a bursting and an explosion of a steam boiler, as there is between the bursting of a cannon by hydraulic pressure or by gunpowder. It is well known that a cannon bursted by hydraulic pressure is perfectly harmless, and the effect of bursting with gunpowder is also known by dreadful experience. In my endeavours to learn the nature and value of high steam, I have been so fortunate as never to have had one explosion, although I have very often had the steam up to a pressure of 100 atmospheres; but I have had more than 100 rends, or burstings. In the Adelaide Gallery where the steam has been up daily to an average of 450 lbs. to the square inch, for more than four years, and where the exhibition of the steam gun has been many times stopped in consequence of the bursting of the generator, yet no report has ever been heard, even by persons within a few feet of the generator. In fact, I never knew a brick to be disturbed by the bursting of the generator. About ten years since I was exhibiting the steam gun in a large assemblage, when in the middle of a volley the

steam dropped, and the balls refused to leave the barrel. I immediately ran to the furnace and found a rent about eight inches long and one inch wide in the centre of the boiler, which was three and a half feet long, seven inches diameter, and three-quarters of an inch thick, of wrought copper. I apologised to the company for stopping the experiment as the boiler had burst; they exclaimed that it was impossible, for they had heard no explosion. My answer was, come and see, which many did, when the astonishment manifested, as well as the pleasure expressed by them, was very great. One gentleman in particular was extremely gratified at being present when the circumstance occurred, he being an owner of steam engines.

The Committee of the Franklin Institute have made experiments upon a subject much pursued by me, namely, to ascertain whether surcharged steam could have its power increased by adding sufficient water to give to it its proper density. In a pamphlet published by me about eight years since, containing observations upon the causes of the explosion of steam boilers. I offered some opinion on this point which found many believers; the opinions then given were the result of much observation, and of numerous experiments. My experiments, however, to ascertain this fact, were conducted in a very different manner from those of the committee. I built my fire under the bottom of a very strong generator, which would bear a pressure of at least 300 atmospheres. The object of this great strength of the generator was not only to enable me to make my experimeut without danger, but to surcharge the steam at a very high temperature, so that there should be no mistake as to the result. The fire was made at the bottom of the generator, about a quarter up the sides, and about as much above the water as below it, observing at the same time to have the fire much more intense above than below the water; but no fire was made *on*, or *near* the top of the boiler, believing that heat would not descend any more in steam than in water. This fact I have now completely established by a new modification of a boiler which owes much of its success to the property which surcharged steam possesses of transmitting heat: the particulars of this modification cannot be made public until I have obtained my foreign patents therefore. If I had made the fire on the top of the boiler, as the committee of the Franklin Institute did, in their experiments, I should have made the same mistake, and instead of surcharging the mass of steam, I should only have surcharged a small film next the heated *metal, and* have left the rest perfectly satu*rated with water, and quite* unfit for receiv*ing a jet of that fluid,* which could only serve to lower the temperature and power, which was the case in their experiments.

At the top of my generator the temperature was at least 3000 degrees, as ascertained by an alloy that fused at about that point; the temperature of the steam in contact with the water was about 300 degrees, the mean temperature about 1500 degrees, that together with the heated sides and top of the generator furnished heat enough to make the indicator rise at each stroke of the pump from 50 to 100 atmospheres; and as the steam was constantly blowing off at the safety valve, which was loaded at five atmospheres, the steam would fall to this pressure in about fifteen seconds. The oscillation of the indicator was from four to five times per minute, its rise was instantaneous, but its fall gradual.

The 9th experiment of the committee was "to repeat Perkins' experiments, and ascertain whether the repulsion stated by him to exist between the particles of intensely heated iron and water, be general, and to measure, if possible, the extent of this repulsion with a view to determine the influence which it may have on safety valves." The experiment made with the perforated thick iron boilers, as far as it went, was very satisfactory. The water standing in a bowl heated up to 800° without passing through the metal, until the metal had lowered its temperature, would be easily seen by any one, and would be an interesting experiment to be repeated in a lecture room.

The committee now proceed to give an account of an unsuccessful attempt to repeat Perkins' experiment referred to in the query. As it does not seem to bear upon the application of the safety valve, they did not deem it necessary to encounter the expense of the apparatus necessary to a further trial. The experiment of Perkins which is more particularly referred to in the query is that in which an opening having been made in one of his generators, containing intensely heated water in contact with the red hot metal, neither steam nor water escaped, and in which having affixed a pipe and stop-cock to the same vessel, no steam issued through the cock when opened. To repeat this with a view to ascertain, as required in the query, the size of the opening to which such a result would apply, three apertures were made, of 1-16th, 1-8th, and 1-4th of an inch respectively, in the sides of a wrought iron mercury bottle; these were closed by conical plugs connected with levers, by which the plugs could be withdrawn from the sides of the bottle. The fulcrums of these levers were attached to the wrought-iron cylinder already referred to, within which, its axis coinciding with

that of the cylinder, the cylindric bottle was placed. An earthenware furnace was placed below the bottle and surrounding cylinder, the latter resting upon wrought iron bars supported by the edges of the furnace, and the former supported by a stone placed upon the grate of the furnace. Besides affording a support for the levers, the wrought iron cylinder was introduced to protect the experimenters against injury, should the bottle explode in the trials to be made with it. The apparatus having been placed in a quarry pit, adjacent to that in which the cylindric boilers were burst, water was poured into the bottle so as to fill it, the screw-plug was next passed into the neck and forced home by lateral blows from a hammer; a fire was now made in the furnace, and the fuel heaped up so as to fill the entire space between the mercury bottle and wrought iron cylinder, and to be about five inches deep above the stopper of the former; a string was attached to the lever connected with the smallest plug, and carried up the bank. The fire soon burned briskly, and it was perceived that a small quantity of steam mingled with the feeble smoke and heated air which rose above the apparatus. About twenty minutes after the beginning of the experiments the leak appearing to increase, an incautious attempt was made to stop it, but without success; at this time the bottle was seen to be at a dull red heat. It was thought that but little water had been able to escape in steam through the very minute opening which the imperfect thread of the screw gave, and it was intended to withdraw one of the plugs, when a few minutes should have elapsed to give time for the bottle to be heated to complete redness; meanwhile a most violent explosion occurred, the body of the bottle rose in the air, the iron cylinder which served to increase the height of the furnace was thrown from its place, the earthen furnace blown to pieces, and the fire scattered far and wide through the woods. After extinguishing the fire, it was found that the iron cylinder, weighing, with the apparatus connected with it, 51¾ lbs., had been thrown four feet from its bed, the plugs which passed into the bottle had been broken short off at the exterior of the bottle, the bottom had been forced into the ground, which was ploughed up by the fragments of the furnace, and completely wet for a considerable distance around: one of the iron bars supporting the cylinder was thrown a distance of thirty feet, and sunk three inches into the ground. The body of the bottle was found thirty yards from its position before the explosion, having penetrated two feet into the ground. The noise of the explosion resembled that of a twelve pounder fully charged. This experiment proved first, that steam, from intensely heated water, was able to penetrate an exceedingly small opening; although it proved nothing in regard to an aperture made in a vessel containing water only, it showed an effect produced when there was very little steam in the vessel. It verified the deduction from theory, that but a small part of water highly heated can expand into steam if suddenly relieved from pressure. "It showed that great danger must be incurred in attempts to heat water very highly even in vessels where it has but little room to expand itself, contrary to the opinions entertained by many, and that an attempt to repeat the experiment of Perkins, unless with an apparatus capable of sustaining the most intense pressure, must be attended with great danger." Although it appears that the boiler was first filled with waste water, yet under such tremendous pressure the water and steam would be rapidly discharged through the small fissure which was observed to have made its appearance, and as the water lessened its bulk, so as to leave a space between the metal and water, it would be repelled from every part of the boiler except at the fissure, which by its blackness would have shown that the temperature of that spot was very much reduced by the issue of steam and water. If the whole boiler showed a dull redness, as was stated to have been the case by the committee, water could not have been in contact with the boiler, but must have been separated by a thin film of non-conducting material; for had the water been heated to dull redness, a boiler of twenty times the strength of that used could not have resisted the resulting pressure. I have no doubt that the water was of a much lower temperature than the steam in contact with it, or the metal which was in contact with the steam. It was observed by the committee that just before the explosion the rush of steam increased. This was undoubtedly the cause of the explosion. It has been frequently observed that when the water had been reduced in the boiler so as to allow the heat to enter above the water and surcharge the steam, as well as heating the upper part of the boiler, that if at this time the safety valve be suddenly raised so much so as to take off the steam faster than it is generated, then the pressure would be taken off from the surface of the water so as to allow it to rise up in mist, and take off the extra heat from the surcharged steam, as well as the heat from the top of the boiler, and become completely saturated; at this time an explosion must necessarily take place. Now, I conceive that the experimental boiler was

in this predicament, and when the fissure had increased sufficiently to take off the pressure from the cylinder of water which was in the interior of the boiler, this water would burst into mist and take up the heat in the surcharged steam as well as the heat of the metal, and produce what was witnessed by the experimentalists. Now if the plug had been withdrawn before the explosion took place, steam and water would have rushed from the hole. How could it have been otherwise? Was not every part of the heated boiler rendered repellent? The aperture was the only place for its escape—thus it would have been made to appear, that the experiment that I published some time since was entirely fallacious. Now if the committee will take the trouble to make the experiment as I made it, or as one was made by Alexander Gordon, Esq., of London, civil engineer, they will witness the fact. Mr. Gordon called upon me some time since and informed me that he had made an experiment to prove whether the facts that I had stated respecting the repellent power of heat were correct. He observed the reason of his not having tried the experiment long before was, because he conceived it entirely contrary to the laws of nature, nor should he have tried it then had he not been called upon by Mr. Ogle, who had been much troubled with the burning out of the bottoms of his tubular boilers. Mr. Gordon stated to Mr. Ogle that if the facts which I had published some time since, were correct, it would be easily accounted for and recommended an experiment, which was determined on. Mr. Ogle's boiler consisted of a group of tubes 3½ feet long, 4 inches diameter, and under one-eighth of an inch think, standing vertically, arranged very close, and the heat of the fire passing up between them. In one of these tubes a series of cocks which ranged from the bottom to the top, say four or five inches apart, were fixed for observing the changes of the water and steam at different temperatures, these cocks were about a quarter of an inch of interior space. The fire was now gently made under the bottom of the boiler, the steam was soon got up, and was allowed to blow off constantly, as fast as it was generated; these tubes contained about two-thirds water and the other third steam; when the lower cock was first opened water issued, as was expected at the temperature; this cock was now closed, and the top opened, when the steam rushed out at about 200 lbs. pressure to the inch. The bottom of the tube was now raised to a higher temperature, and when the lower cock was *opened, steam and water escaped*; this cock *was then closed and the* upper one was opened, and steam and water came out there also. The top was now closed, the fire was urged to a much higher temperature, and the bottom of the boiler showed a dull redness, and when the lower cock was opened nothing but steam issued; this cock being shut, the upper one was opened, and water only issued—evidently showing that all the water was at the top of the tube. The fire was now urged to a much greater intensity, and the bottom became red hot, and when the cock was opened nothing was heard, neither was steam seen to issue; but Mr. Gordon thought he smelt hydrogen, which was undoubtedly the case.

SOCIETY OF ARTS.—DISTRIBUTION OF REWARDS.

Monday last, being the day appointed for presenting to the respective candidates the rewards adjudged by this Society during the present session, a numerous assemblage of ladies and gentlemen, amongst whom we noticed Prince Menzikoff, who has accompanied the Grand Duke of Russia in his journey to this country, Professor Dosini, and several other distinguished foreigners, were present on the occasion at the rooms of the Society, in John-street, Adelphi.

At one o'clock his Royal Highness the Duke of Sussex entered the room amidst loud cheers; and having taken the chair, said:—"Ladies and Gentlemen, I beg to express the great pleasure that I have in meeting the present company on so interesting an occasion. I think it adds considerably to the interest of the meeting that the rewards are distributed under our own roof again. (Cheers.) [They have been for some time distributed at the Hanover-square Rooms.] I believe it will be found that there are *fewer prizes than heretofore;* and I doubt not that the committee individually regret, as it is a matter of some regret to me, that we have not the satisfaction of distributing so many prizes now as formerly, and of thereby obtaining the smiles particularly of the ladies on the occasion. Yet, after all considerations, perhaps it will be found that reducing the number of prizes will increase the activity created in acquiring them, and that the value of the compliment will in those instances be enhanced. (Cheers.) I believe it will be found, generally speaking, that with regard to honours of every kind, economy in the bestowal of them adds greatly to their importance, and to the benefit they produce. (Cheers.) I will not detain the company any longer at present, and will only say that it shall always be a source of great gratification to me to assist in any way this so very instructive a society."

The report of the Society was then read by Mr. Aiken, the Secretary, (who, we regret to hear, from ill health has resigned his office.) The report *made no allusion to the finances of the Society*, but dilated on its scientific proceedings, and on its communications with other scientific associations and personages, from which discoveries of much general usefulness are *likely* to result.

The report having been read, the various prizes were then presented to the successful candidates by the illustrious Chairman, who accompanied the presentation of each with a suitable address.

The following are those connected with mechanics and other practical arts:—

1. To Mr. J. T. Cooper, Polytechnic Institution, Regent-street, for his method of preparing paper for photographic drawing, the silver medal.

2. To Mr. R. Redman, 43, Great Wild-street, Lincoln's Inn-fields, for his method of making transfers from copperplate printing to zinc or stone, the silver Isis medal and 5*l.*

3. To Mr. H. C. Page, 5, Commercial-road, Pimlico, for his method of lettering on polished marble, the silver medal.

4. To Mr. W. H. Thornthwaite, 3, James-place, Hoxton, for his apparatus for the use of divers, the silver medal.

5. To Mr. W. Jones, 6, Horseshoe-court, Ludgate-hill, for his travelling platform, the silver Isis medal.

6. To Mr. M. Jennings, Portsmouth-street, Lincoln's Inn-fields, for his night signals for steamers, the silver Isis medal.

7. To Mr. J. Hopkins, Globe Brewery, King's-row, Horsleydown, for his scale lever, the silver Isis medal.

8. To Mr. B. Holmes, clerk of the works at Chatsworth, for his spring-bolt plate, the silver Isis medal.

9. To Mr. J. Gray, 25, Old Burlington-street, for his improved instrument for extracting teeth, the silver medal.

10. To Mr. A. Wivell, 20, Cardington-street, Hampstead-road, for his fire-escape, the silver medal.

11. To Mr. Joseph Jeay, 6, Oxford-market, for his method of determining the lengths and bevels of timbers in a hip roof, the silver Isis medal.

12. To Mr. C. Hanshard, 35, Sebright-street, Bethnal-green, the silver Isis medal and 5*l.*

13. To Mr. Jas. Cole, 38, Sebright-street, Bethnal-green, 5*l.*

14. To Mr. J. Sodo, 6, Sebright-street, Bethnal-green, 5*l.*

For their *respective shares in the invention and improvement of the tube used in weaving wide silk velvet.*

15. To Mr. J. Dove, 9, Surat-place, Green-street, Bethnal-green Road, for his improved machine for weaving silk tissue, the silver Isis medal and 10*l.*

Amongst the prizes in the department of Fine Arts we must notice one earned by most arduous efforts, viz:—Mr. Robert Billings, Manor-house, Kentish Town, the Acton gold medallion for his analysis of the great eastern window of Carlisle Cathedral. This prize was the first of the kind, being conferred in pursuance of the object of a fund of 500*l.* lately presented by the widow of a gentleman who had long been a member of the Society. The recipient of the prize wore no less than seven medals which he had obtained from the Society on previous and successive years. The window above named, it appears, though now in a state of decay, still bears evidence of extreme artistical beauty, and the successful effort of Mr. Billings has been so to analyse its curious composition as that, if the window should now fall to pieces, an exactly similar one could again be formed. The window proves the profound mathematical knowledge of the ancient architects, as it has been found to contain such curious astronomical and mathematical devices as if the artists on the occasion had anticipated the improvements of the present age.

The prizes having been distributed, the illustrious Chairman begged, in the name of the Committee, to return thanks to those who had attended on that day. It was most important that the character of the institution should be kept up, and it was by the activity of the Committee, and by the economy of remuneration, that both these objects would be best served. It had afforded him great pleasure to listen to the interesting address of the Secretary, to whom they were all aware that the Society was so much indebted—(cheers),—and he trusted that he would be spared for many years to a society, the object of which was the benefit of mankind.—(Cheers.) He trusted that those gentlemen and ladies who honoured them with their presence on that day would use their influence with their acquaintances in explaining what they had that day seen—and the ladies would do so he hoped in that happy way which ladies have of conveying their opinions—(a laugh,)—in order to increase the utility of an institution in which no one felt more deeply interested than he did, and particularly in that branch of it which encouraged the different species of invention which appertained to the class which was called the labouring class of society.—(Cheers.) It was to that sort of encouragement that he looked with confidence for benefits to the country of the

highest order. It was by such means that the sympathy of the people would be called up. (Cheers.) An encouraging spirit on the one side would create confidence and attachment on the other.—(Cheers.) That was the mode of governing a country like this, in which public opinion would always be of the greatest weight. It was by that species of kindly feeling between one another that distinctions were kept up and submitted to, and that confidence was promoted because benefits were mutual.—(Cheers.) He was glad that they were honoured on the occasion by the presence of a foreign Prince, by a learned professor, and other distinguished foreigners. He was delighted to see a distinguished Italian professor present, who would be enabled to observe how we conduct business here, and who would find that though our forms are different from those of his own land, yet we are always ready to show respect and affection to the enlightened of other countries.—(Cheers.)—We now live in a time of peace, and the exchange of kindly feeling not only ought to exist, but ought to be encouraged as well as also all those arts of peace by which mankind are benefited.—(Cheers.)

A MODE OF ANALYSING GERMAN SILVER.

BY J. C. BOOTH.

As the employment of this interesting compound is daily becoming more general, it becomes a point of some importance to the manufacturer to ascertain with some accuracy the composition of those kinds in the market, which are adjudged to possess superior qualities. For this purpose I have contrived a method of analysing them, which may be successfully practised by any one who possesses a little chemical knowledge. A small piece of about 20 grains is dissolved in nitro-muriatic acid with the assistance of a gentle heat, by which means the metals will be converted into chlorides. If the solution be filtered through a small paper-filter, and a white powder remain after washing with water, it is the chloride of silver, the presence of which metal in the compound is accidental and scarcely appreciable. The acidulated solution is then treated by sulphuretted hydrogen, which separates copper and a little arsenic. The sulphuret of copper is collected on a filter, treated with nitric acid in a gentle heat, till the sulphur appears whitish, then filtered, brought to boiling, precipitated with caustic potassa, filtered and weighed. 100 parts of this precipitate contains 79.83 *of metallic copper. To the* solution after *filtering off the sulphuret of* copper, a little nitric acid is added, and the whole heated in order to convert the protoxide into the peroxide of iron. Muriate of Ammonia is then added to the same and a small excess of ammonia, which precipitates only the peroxide of iron. This may be collected on a filter and weighed, 100 parts of it contain 69.34 of metallic iron. The solution is now to be treated with carbonate of soda and evaporated to dryness; the dry mass is treated with hot water, and the residue washed and dried. This powder, consisting of carbonate of zinc and nickel, is mixed half its weight of saltpetre and ignited until the whole is nearly dry. It is transferred to a filter after being powdered in a small mortar, and is then washed two or three times with pure, but dilute, nitric acid, which dissolves the oxide of zinc, and leaves the *peroxide* of nickel. To the zinc solution carbonate of soda is added, the whole evaporated to dryness, treated with hot water, and the remainder after being dried and ignited is weighed, 100 parts contain 80.13 metallic zinc. The peroxide of nickel is dissolved in hydro-chloric acid, precipitated by caustic potassa, filtered off and weighed, 100 parts of it contain 78.71 metallic nickel.

The separation of nickel and zinc is ever attended with difficulty and some uncertainty, it but is rendered much more simple by the method which I propose, and which is not more inaccurate than others in use. Before weighing any of the above oxides, it is decidedly preferable to burn the filter after shaking off as much of the substance as possible into a platinum crucible, to add the ashes, and then subtract their weight from that of the oxide.—*Franklin Journal.*

ROYAL INSTITUTION—WILKINSON'S WHEEL RIFLE.—THE VINEGAR RIVER.—MR. CARPMAEL'S LECTURE ON BUTTON MAKING.

May 24.—*The Conversazione.*—Our attention was particularly drawn to a wheel-rifle by Mr. Wilkinson, in which the wheel charging principle, although by no means a novelty, appears to be carried into effect in a very efficient and perfect manner. Such a gun would be invaluable in tiger hunting, but for man hunting and slaying, only men who are themselves of the tiger breed would wish to see it in use. There was also on the table, from the same gentleman, a Turkish gun, in which the contrast between the useful and the ornamental—the lock and the inlaid work—was truly remarkable. The latter was marvellous, and might well occupy the whole life of a workman. But it is not in Turkey alone that a factitious value

is attached to what is merely elaborate in execution; for there was exhibited a specimen of Mr. Minusi's pen and ink drawings, being a portrait of old Isaac Walton. Though certainly very beautiful in itself, an appreciation of it solely on that ground would but ill satisfy its admirers, if no reference were made at the same time to the means of its execution. How much more wonderful and valuable, then, would it have been, if it had been executed by that gentleman's foot instead of his hand! Among other curiosities was a sample, sent by Mr. Turner, of the water of the Vinegar river, near Popayan, South America. From an analysis by M. Rivero, it appears that its acescent quality is due principally to the presence of sulphuric acid, though there is also a slight portion of muriatic acid.

The Lecture.—The subject on which Mr. Carpmael lectured, was "The manufacture of covered buttons," and his object was, to exhibit as well as to explain the several mechanical processes which are successively had recourse to in the formation of that kind of covered button, consisting of a combination of metallic disks and of silk and woollen fabrics, which has now so universally superseded those which, only a few years since, were made by hand. Those of our readers who feel any interest in the subject would, by taking to pieces one of these buttons, and with the help of the few observations we think it necessary to make, obtain in one minute a much clearer insight into the construction and mode of manufacturing it, than by any mere description we could give. Even the lecturer, with all the tools before him, and by going through the process itself, failed, in respect to the greater part of the audience at least, in giving a good exposition of the subject, partly because of a want of tact in the management of it, and partly on account of the minuteness both of the articles and of the operations. Lecturers should know, that what is perfectly plain and visible to them, is not so to the audience, or if aware of it, they should understand, that it is no valid excuse to acknowledge and lament it as being something unfortunate, whilst they have it in their power to rectify the evil, by exhibiting forms and proceedings on a much larger scale. The real processes should, however, by no means be omitted, if it is possible to introduce them, but in minute and technical matters like these, they should be preceded by models so large, and operations so magnified, as to speak at once to the eye, and render the subsequent proceedings easy at least to be apprehended and imagined, though they should not be clearly perceptible to the sight. Thus, *in the present instance*, the lecturer should have introduced a model of a button, as a friend of ours facetiously exaggerating remarked, "as big as a cart wheel," and this should have been *first* fully explained and exhibited in all its parts, arrangements, and connections. The several mechanical processes by which the parts are manufactured, would then have been understood; and the bearing and the adaptation of the successive steps taken in the formation of the button, would then have been clearly seen as the lecturer went on. We cannot follow him, but must give our own account.

This manufacture is a striking instance of the utility of the principle of the division of labour. Nothing is more simple than a hand-made covered button. It is not like a pin—Adam Smith's favourite illustration —which it would be some trouble, and require some manual dexterity to make. A less likely article than a covered button could scarcely have been thought of, from which to derive any advantage, by making it on the principle of the division of labour, though assisted by mechanical aids; for to bring it within the scope of such appliances, it is obliged to be made in a tenfold more complicated manner. It is to be observed, that there is as yet no such thing as a button machine; this is generally the last step in invention, and can seldom compete with a *mechanically assisted* manufacture, conducted on the principle adverted to. Though the button thus made has a greater number of parts, as well as being for the necessity of the case much more intricate in its construction, and has to go through ten or a dozen different processes, yet the fact of its passing through as many hands as there are manipulations, is the very cause of its being better and more cheaply made.

Taking it for granted that our readers have obtained the same knowledge of the construction of such a button, from an actual examination of it, which we have stated that the lecturer ought first, from an exhibition of a model, to have imparted to his audience, they will have no difficulty in perceiving how that all its parts, composed as they are of differently sized disks of sheet iron, of paper, of woollen and silk fabrics, may be stamped or cut out by differently shaped punches and dies, under the operation of a fly press; each piece so cut out, and every form subsequently given to it by similar means, being the result of so many distinct operations, performed by as many different workmen, with as many different sets of screw presses, punches, and dies. The component parts are then secured and connected together by a similar mode of operating. The first made buttons of this

description have the collet or disk of iron at the back serrated round its circumference, the projecting teeth of which being forced through the fabric of the covering as gathered in at the back of the button, and coming in contact with the front disk, are turned in and rivetted down by the action of the press, thus holding together the different parts. Another mode consists in making the collet, with the projecting rim plain instead of serrated, but with a slight flange all round, and connecting the parts together by means of the front disk, which is also made with a projecting rim, but it is larger than the collet, so as to inclose it, the hollow parts being towards each other; which rim is, by means of the press, folded in along with the covering, and forced down upon the flange of the collet. The interior of this button is filled with a disk of thick paper, and it has a very neat appearance, lying very flat upon the cloth. It is, we believe, made under Mr. Aingworth's patent.

Such is the facility and dexterity which the workman acquires by his attention being confined to one part of the process, that he is enabled to stamp, or mould, or cut out materials to the number of from 70 to 150 gross in a day. It is this which has enabled the manufacturer, notwithstanding the number and complexity of the proceedings, to drive all the old kind of buttons out of the market, and consequently the consumption of materials is proportionate, being by an estimate, which Mr. Carpmael did not advance as pretending to any very particular accuracy, about 20 tons of sheet iron, 4 tons of paper, and 4 or 5 thousand yards each of woollen and silk fabrics per month. Several refinements have of late been introduced into the manufacture in regard to the covering of the buttons, some of which are not yet in the market. A figured silk has been woven for the purpose, the centre of the sprig or pattern being kept to the centre of the button by a pin passing through a hole in the front iron disk. Another plan is to emboss the pattern on plain silk, and in very high relief, for which purpose some softened shell lac is put on a small disk of paper, upon which is placed a larger disk of silk, and in this state being stamped, a highly raised impression is procured from the intaglio die, which will not sink and be obliterated on being wetted, as would be the case if the pattern was embossed on the silk alone. Gold and silver tissues also are made for the coverings, and these have a very splendid appearance. The series of punches and dies on the Lecturer's table were well worthy observation and admiration, on account of their beautiful accuracy and high finish. We know not on what data Mr. Carpmael states that 20 tons of iron is used in this manufacture per month, but allowing one-fourth for waste, and eight grains to be the average weight of the iron disks, the number of buttons manufactured must be 352 millions in the year, sufficient to supply eleven million of coats, and the like number of waistcoats per annum.

NOTES AND NOTICES.

Thames Tunnel.—This great national undertaking is rapidly progressing, and the most sanguine expectations are entertained of reaching low water-mark, on the Middlesex shore, before the termination of the summer. The works have now progressed to within 35 feet of Trinity low water-mark on the south side, and from the state of the shield and the general appearance of the excavation, it is believed that all danger has been surmounted. When low water-mark is reached, a shaft will be sunk on the Wapping side of the river, and the workmen will continue their labours at both ends of the Tunnel. It is expected that the subterranean communication between Surrey and Middlesex for foot passengers, will be opened in about two years. The number of visitors has greatly increased of late, and the book which is kept in the Tunnel for the entrance of names contains the signatures of the most distinguished characters in Europe, including many scientific men. The United States appears by the book to have furnished its quota of visitors. The Grand Duke Alexander of Russia and Prince Henry of the Netherlands have inscribed their names in the visitors' book. The labourers, with few exceptions, enjoy tolerably good health.—*Times.*

The Marquis of Tweedale's Drain Tiles Machine.—This machine will make 10,000 drain tiles a-day, one man and two boys to attend it, and 20,000 of flat tiles for the drain tile to lie upon; but if the tiles are broad for roofing, it will make 12,000 a day. These draining tiles are 15 inches long, so that three machines would make in one season (of 30 weeks) as many tiles as would lay a drain from London to York. Now, a man and two assistants will only make 1,000 drain tiles in a day, and these only one foot long, which is 1,000 feet per day; so that if the drain be laid at the distance of 25 feet, it will make in one day sufficient tiles for six acres. The advantages are—1st, the tile is much stronger from being compressed and less pervious to water; it is not only compressed, but it is smoothed over, which gives it a surface as though it were glazed. They are capable of being made of a much stiffer clay than usual, and in nine cases out of ten the clay may be used directly on being dug, if passed through the crushers, being much drier. Clay unfit for bricks and tiles by the common method, is available by the machinery. The expense of draining will be paid in three years, but not unfrequently in one.—*Farmer's Magazine.*

The thirtieth Volume of the *Mechanics' Magazine* will be published on the 1st of July, illustrated with a splendid engraving of a LOCOMOTIVE ENGINE AND TENDER—the size of a sheet and a half of demy paper—exhibiting the whole of the machinery of the engine, and explaining its action.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough*-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

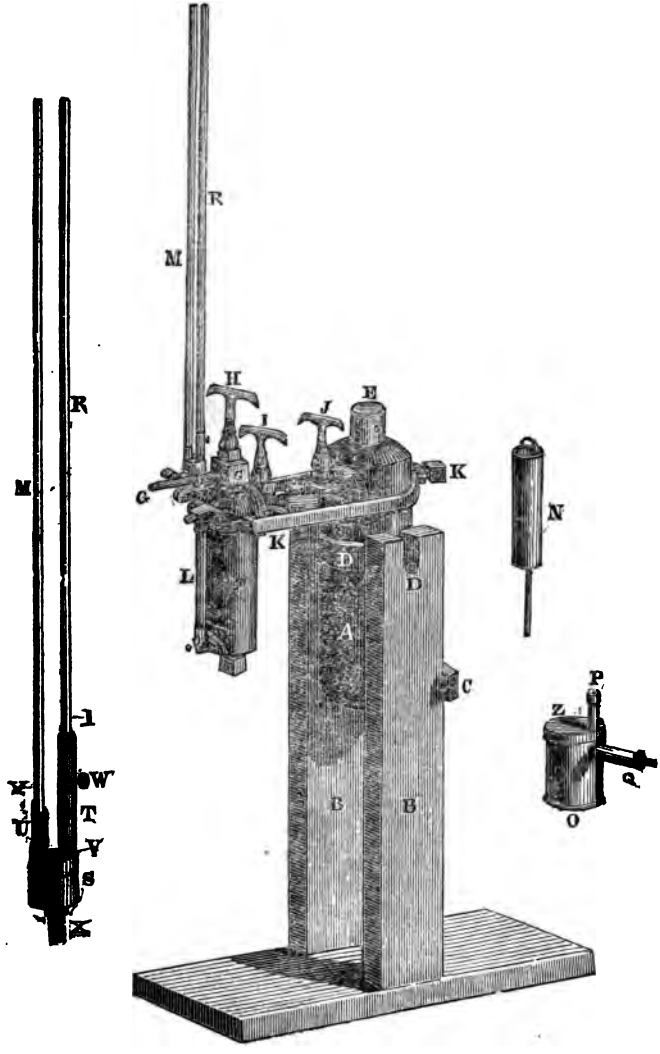
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 828.] SATURDAY, JUNE 22, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Roberts-in No. 6, Peterborough-court, Fleet-street.

DR. MITCHELL'S APPARATUS FOR LIQUEFYING AND SOLIDIFYING CARBONIC ACID GAS.



ON THE LIQUEFACTION AND SOLIDIFICATION OF CARBONIC ACID. — BY J. K. MITCHELL, M. D.

[From the *Franklin Journal.*]

In the year 1823 public attention was strongly drawn to the subject of the liquefaction by pressure, of the, so called, permanent gases, by Mr., now Sir Michael Faraday * Among the ærial fluids, carbonic acid was distinguished as requiring a force of 36 atmospheres at 32° F. to coerce it into the liquid state. His ingenious and hazardous experiments were conducted in glass tubes; and he depended on the accumulation of newly generated gas for the necessary pressure.

Mr. Brunel, † in a subsequent endeavour to apply compressed gases to mechanical purposes, produced a pint and half of liquid carbonic acid, which, even at high temperatures, he confined in a series of small brass tubes not above the $\frac{1}{30}$ of an inch in the thickness of their walls.

This interesting subject was not again publicly agitated, until the appearance in December, 1835, of a report on the liquefaction of carbonic acid on a comparatively large scale. In the last number for that year of the *Annales de Chimie et de Physique*, M. Thillorier described the properties of liquid carbonic acid in detail. According to him this liquid demands for its existence as such at 32° F., a pressure, as stated by Sir M. Faraday, of 36 atmospheres. Its specific gravity is at the same temperature 0.830, at—4° F.—0.900, and at 86° —0.600. It is therefore enlarged by heat 3.407 times as much as its own or any other gas, when carried from 32° to 86°. From— 4° to 32° its expansion is almost exactly equal to that of the gases.

M. Thillorier found also that the expansive force is altered by heat so as to amount at 86° to 73 atmospheres, and at —4° to 26 atmospheres. The density of the gas when resting over the liquid at 86°, is stated at 130 times the density of that which is compressed by the force of one atmosphere. Its pressure is therefore at 86° not much more one-half of that which its density would indicate.

When liquid, the carbonic acid is, on the same authority, immiscible with water and the fat oils, but is readily united with ether, alcohol, naphtha, oil of turpentine and carburet of sulphur. Although potassium decomposes it, lead, iron, copper, and the other easily oxidized metals, do not act on it ‡

The theometric temperature observed in jet by Thillorier, appears to be erroneously stated; for, as the *solid* is, at its formation, not below—90°, and as the act of solidification of any vapour or liquid keeps the temperature, for the time, at the highest point compatible with the existence of the particular solid under observation, it follows that the jet of carbonic acid cannot fall below its freezing point. Immediately after its production, the carbonic snow begins to grow colder, and may be made to reach— 109° in the air,—136° under an exhausted receiver. When moistened with ether, it can be depressed to —146°. Professor Hare's ether acts much more effectually than sulphuric ether.

At the immediately subsequent sitting of the Academy of Sciences, Thillorier announced the important fact that he had solidified carbonic acid. This he effected by suffering the liquid to escape into a bottle, or box, where by the sudden gasefaction of a part, the remainder was frozen by the extreme cold thus produced. The solid is white, light, evaporable and excessively cold. Because, surrounded by an atmosphere of gas which is constantly escaping from it, a fragment of it touched lightly by the finger glides rapidly over a plane surface.

Its evaporation is so complete as to leave no other trace of moisture than that which is caused by the coldness and consequent atmospheric humectation.

The force of its gasefaction is alleged to be equal to, but not so sudden as, that of gunpowder.

The temperature at which the solidification took place was presumed to be about —148° F; although the experiments before the committee of the Academy showed —124°.

Such is, in substance, the account by M. Thillorier of his novel and curious discovery, reported in the *Annales de Chimie*. No description of the method of procedure, or of the apparatus used, is annexed; and we are left to conjecture, and to the imperfect description of travellers, for any farther knowledge of either.

Having repeated the experiments of Thillorier, I deem it not useless to subjoin a draught of the instrument with which, aided by the suggestions of an intelligent pupil in France, and the assistance of friends here, I was enabled successfully to repeat most of the experiments of Thillorier, and to verify some, and correct other, of his results.

* Philos. Trans. Lond.

† Quart. Journ. vol. xli.

‡ Among the most remarkable of the phenomena *observed by Thillorier was* the intense cold *produced by the sudden liberation* of the liquid *and its conversion into gas.* A jet of it depressed the thermometer to —130 F., and when sulphuric ether had been previously mixed with the liquefied gas, the refrigerating effects were more marked both on mercury and the sensations.

The apparatus consists of a generator of cast iron, A, supported by a wooden stand, B, a receiver, F, also of cast iron, connected to the generator by a brass tube, and fastened firmly to it by the stirrup screw, K; H, I, J, are stop-cocks, G the nozle of a pipe, L a glass level-gauge, and S, M, R, a pressure-gauge.

The generator is 20 inches long and 6 inches in diameter exteriorly. Its cavity is 16 inches deep, and 3 inches nearly in diameter, so that it will hold about 4 pints. The walls are, of course, about 1½ inch in thickness. At the top an aperture of two inches in diameter is closed by a strong wrought-iron screw, the shoulder of which is let in about a quarter of an inch. The collar is of block tin turned to the size of the shoulder of the screw. There is a hole in the head of the screw E for the reception of a long, strong iron bar.

The copper cup, N, 1¾ inches wide, and 9 inches long, holds about 12 fluid ounces. There is a little handle at the top, and a copper wire at the bottom which make the whole length a little less than that of the cavity of the generator. This cup is used to introduce the sulphuric acid.

The brass tube between the generator and receiver is divided into two parts of equal length, which admit of being united by means of a conical juncture, kept tight by the stirrup and screw, K, K. Each of these portions of the tube may be closed or opened at pleasure by a stop cock. One is placed at I, another at J; so that when the receiver is being separated from the generator, the contents of both may be retained. The stop-cocks in common use are inadequate to resist the pressure, and therefore a screw stop-cock is indispensable. It is made to close a small aperture by means of a conical point, and having a double cone, it closes an outlet also when the cock is completely open, so as to prevent the escape of gas by the sides of the screw.

The receiver, F, is of the capacity of about a pint. The pipe, G, G, turned at a right angle at G, descends so as almost to touch the bottom of the cavity in F. The stop-cock H, G, is similar to I and J. L is a glass tube connected at each end to a socket of brass, which communicates with the interior of F. It is the gauge for observing the level of the liquid in T.

The gauge for measuring the pressure is peculiar. Into a wrought iron box, S, are inserted, by screws, two sockets, T and U. The former descends almost to the bottom of the box, which is nearly filled with mercury. *Through the axis of the screw, X, a small tube passes into the cavity of S, and is continued to the top of it, so as to rise above the mercury.* Two strong barometer tubes, R and M, are cemented* into U and W, and hermetically sealed at the upper ends. These tubes are carefully graduated. In one of them, U, a short cylinder of mercury is made to stand at Y at the commencement of the experiment. The other, socket and all, is full of air, as no mercury is introduced into it. A very fine screw at W enables the operator to regulate the quantity of air in T.

The tin cup, O, used to collect the solid acid, is covered by a lid, Z, perforated by a pipe, P, whose top is full of small holes. The handle, Q, is hollow, so as to fit the end of the pipe of the receiver at G. To secure the hand of the operator from the cold produced by the experiment, the handle is carefully wrapped up in some kind of cloth.

The apparatus is prepared for use by removing the screw E, and placing 1¾ lbs. of bicarbonate of soda in the generator, A, to which 24 fluid ounces of water are to be added. After making these into a thin paste by stirring, nine fluid ounces of common sulphuric acid are to be poured into the copper cup, N, and that is to be let down by a crook of wire into the generator. After the screw E has been firmly applied, and the stop-cock, J, closed, the contents of the generator are to be brought into admixture by moving it round to a horizontal position on the swivel, D, which is supported by the wooden frame, B, B. There is a check bar at C. This motion is to be repeated several times. In about ten minutes the whole of the carbonic acid is liberated, and exists in A, chiefly in a liquid state.

The next step in the process is to attach by means of the stirrup and screw, K, K, the receiver F, *previously cooled by ice*. The keys, I and J, may then be opened slowly, and instantly the liquid carbonic acid is perceptible in the gauge, L. At the end of ten minutes the communication with the generator may be cut off, when about eight fluid ounces of liquid acid at 32° F. will be found in the receiver.

By letting this liquid into the box, O, through the pipe, G, a large part of it is instantly expanded into gas, which escapes through the tube, P. The coldness consequent on the enormous expansion freezes

* The cement used was made of shell lac three or four parts, white or crude turpentine one part, melted at as low a temperature as possible so as not to make bubbles in the mixture. This cement is very strong, but liable, without great care in the regulation of the heat, to have capillary tubes in it from the vaporization of the turpentine. This defect may be completely corrected by cutting away, when cold, the external mass of cement, and putting on a little common cap cement, which melts at a much lower temperature and closes the tubes.

another part of the liquid, which falls to the bottom of O. About one drachm of solid matter is thus formed for each ounce of liquid.

The porosity and volatile character of the solid renders its specific gravity of difficult ascertainment. When recently formed it is about the weight of carbonate of magnesia, and when strongly compressed by the fingers, its density is nearly doubled. Solid carbonic acid is of a perfect whiteness, and of a soft and spongy texture, very like slightly moistened and aggregated snow. It evaporates rapidly, becoming thereby colder and colder, but the coldness produced seems to steadily lessen the evaporation, so that the mass may be kept for some time. A quantity weighing 346 grains lost from 3 to 4 grains per minute at first, but did not entirely disappear for three hours and a half. The natural temperature was 76° — 79°. The solid is most easily kept when compressed and rolled up in cotton or wool. Its temperature, when newly formed, is not exactly ascertainable, because it is immediately lowered by evaporation. Thillorier seems to have entertained the opinion that the greatest degree of cold was created at the time of the formation of the solid. In my experiments a constant decrease of temperature was observed; which was accelerated by a current of air, or any other means of augmenting evaporation. At its formation, the carbonic snow depresses the thermometer to about —85°. If it be confined in wool or raw cotton, its cooling influence is retarded; if it be exposed to the air, especially when in motion, the thermometer descends much more rapidly; and under the receiver of an air-pump, the effect is at its maximum. The greatest cold produced by the solid carbonic acid in the air was—109°, under an exhausted receiver—136°, the natural temperature being at + 86°.

The admixture of sulphuric ether, so as to produce the appearance of wet snow, increased the coldness, for the temperature then fell, under exhaustion, to—146°.* a degree of cold which we were not able exceed by means of any variation of the experiment. That result is most easily obtained by putting about two fluid drachms of ether into the iron receiver before charging it. A compound liquid may be thus formed, which yields a snow in less quantity, but of a more facile refrigeration. Alcohol may replace ether in either mode, but with less decided effect. In the air the alcoholic mixture fell to—106° and remained stationary. By blowing the breath on it, it fell to—110. Left to itself, it rose slowly to 106°; but on being placed under an exhausted receiver, fell to—134°.

Every attempt to wet the carbonic solid with water, failed, so that no estimate of its relative effects could be made.

The experiments resulting from the great coldness of the new solid were very striking. Mercury placed in a cavity in it, and covered up with the same substance, was frozen up in a few seconds. But the solidification of the mercury was almost instantly produced by pouring it into a paste made by the addition of a little ether. Frozen mercury is like lead, soft and easily cut. It is ductile, malleable, and insonorous. Just as it is about to melt, it becomes brittle or 'short,' and breaks under the point of a knife. These facts may account for the discrepancies of authors on this subject. Frozen mercury sinks readily in liquid mercury.

At about—110°, liquid *sulphurous acid* is frozen, and the ice sinks in its own liquid, and at—130° *alcohol* of .798, assumes a viscid and oily appearance, which, by increase of cold, is augmented until at—146° *it is like melted wax*. Alcohol of 820 froze readily.

At—146° *sulphuric ether* is not in the slightest degree altered.

When a piece of solid carbonic acid is pressed against a living animal surface, it drives off the circulating fluids and produces a ghastly white spot. If held for 15 seconds it raises a blister, and if the application be continued for 2 minutes, a deep white depression with an elevated margin is perceived; the part is killed, and a slough is in time the consequence. I have thus produced both blisters and sloughs, by means nearly as prompt as fire, but much less alarming to my patients.

The specific gravity of liquid carbonic acid may be estimated either by weighing a given measure of it in a tube, and deducting the weight of the tube, and of the superincumbent gas, or by means of very minute bulbs of glass, as suggested by Sir M. Faraday. By the latter means I obtained the following results, which are compared with those of Thillorier:—

		Thillorier.	
Temp. Fah.	Sp. Gr.	Temp. Fah.	Sp. Gr.
32°	.93	32°	.83
43°.5	.8825		
51°	.853		
74°	.7385		
86°		86°	.60

The specific gravity particularly at 32°, was examined repeatedly, and with different bulbs, and always found to be at, or very

* *As—146 + 32 = 178, the cold is nearly as far below the ice-point as 212—32 = 180 is above it.*

near, to 93. The difference never amounted to .005. The sp. gr. as given by Thillorier at 32° is 33. The anomalous expansion of the liquid as indicated by both sets of experiments is truly surprising. By mine 73.85 parts raised from 32° to 74°, or 42° become 93 parts, and gain 19.15 parts, while the same bulk of the gases acquires in the same range of temperature only 6.46 parts, or the liquid is expanded very nearly three times as much as its own or any other gas. According to Thillorier, 60 parts gain 23 parts by an elevation of 54°, while the same bulk of air would under like circumstances be augmented only by 6.75 parts; or the liquid is nearly four times as expansive as the gases.

As below 32°, or at reduced pressures, the augmentation of temperature is productive of much less expansive influence, we may infer that under the weight of a few atmospheres, as when near to its freezing point, liquid carbonic acid is scarcely more dilatable by heat than water. Between —4° and + 32°, its expansion is 0.053 while that of air is 0.069. These facts suggest the inquiry how far water at *very high temperature and pressure* may be obedient to the same expansive influence, and thus by suddenly filling the whole interior of a boiler, sometimes cause explosions.

The pressure of carbonic acid gas, when placed over its liquid, is given by Thillorier at 32° and 86°, as 36 and 73 atmospheres respectively. By means of the guage S, M, R,—I found the pressure as follows:—

32°	36	atmospheres.
45°	45	do
66°	60	do.
86°	72	do.

The principle of the guage renders it capable of registering the pressure with great accuracy:—for as one tube, M, begins to mark the pressure from the commencement of an experiment, and the mercury in the other, R, does not reach a visible point until the first has shown a pressure of several atmospheres, the second tube is equivalent in effect to one of several times its length. The first determines the amount of pressure, at which the mercury reaches the initial point on the 2nd, and the 2nd, subsequently, exhibits the multiplications of that initial quantity. Thus, if when the mercury is at five atmospheres in M, it is at the unit mark in R, the value of that unit will be five, and the numbers representative of the pressure on R, must be multiplied by five; or R is equal in effect to a tube of five times its length. By these means very short tubes may be used to determine very high pressures. Inequalities in *temperature, irregularities in the cement, and other causes,* may vary the capacity of the socket T, W, but as M always signifies the unit for R, in each case, no error can arise from these causes. There must, of course, be a correction for the weight of the mercurial column in R, which is to be added to the product. Care must be taken to keep the temperature of the vessel which holds the liquid below that of the guage and tubes, otherwise the liquid will be formed by condensation in the latter. This actually happened in the attempt to ascertain the pressure at 86°, when the natural temperature was 75°. Bubbles of gas were seen ascending through a liquid in M, up to its surface at a few inches below the mercurial cylinder. This as far as relates to the tubes may be avoided by prolonging the socket of M, down into the mercury of the cup, so as to include a cylinder of common air between two cylinders of mercury, and prevent any carbonic gas from entering either the socket, or the glass tube. A correction for the weight of this column, must in such case be made.

When a glass tube, hermetically sealed at one end, and cemented into a brass socket and screw at the other, is attached to a charged receiver and cooled by snow or pounded ice, liquid carbonic acid may be collected in it. It is perfectly colourless and transparent, and the specific gravity bulbs, previously introduced, are seen to ascend or descend, as the temperature is altered. When the tube so charged is opened, the liquid becomes violently agitated, escapes rapidly, grows colder and colder, and finally the remainder is converted into a solid, more dense than the snow already described, but nearly white, and very porous. If the tube be exposed to a paste of carbonic snow and ether, the liquid is solidified into a mass which is not porous but which sinks in the liquid as the latter is formed again by the melting of the solid.

The analogy between liquid carbonic acid and water, is thus completed, for we have liquid, vapour, snow, and ice, exhibited by both.

By the previous introduction of water, ether, alcohol, metals, oxides, or oils, &c. into such tubes, and then filling them with liquid carbonic acid, the resulting phenomena may be easily observed. Water being heavier rests below the new liquid, and does not appear to mingle with it even at the surface of contact, for when the latter is let off, no bubbles appear in the water, and it is frozen at the top into a solid ice.

When alcohol or ether is introduced, the new liquid falls through it in streams, as water would do, but soon renders it milky by mixture. The removal of the pressure causes a violent effervescence, and imme-

diately the clear, colourless ether, or alcohol, is seen alone in the tube; no solid being formed. When alcohol holds shellac in solution, the acid causes its precipitation in light whitish flocculi, which are immediately re-dissolved when the acid is suffered to fly off. Nothing remains but the brown lac-stained liquid.

Liquid carbonic acid did not appear to act on any of the metals or oxides, but the experiments on this point demand a further examination. Its inaction is probably owing to the want of the force of "presence," or of "disposing affinity."

When the liquid has been frozen in a tube of glass, the tube may be melted off by the blow pipe, and hermetically sealed. Such a tube will always retain the liquid, or gas, the former, if in sufficient quantity, at all temperatures, if not, the latter alone will be found in it at high temperatures. I have one such tube, which begins to show moisture at 56°, and exhibits a constantly elongating cylinder of liquid, as the coldness is increased. At 32° the cylinder is about half an inch in length.

Carbonic acid mechanically powerful as it is, is not applicable, perhaps, either to locomotion or projection; but though the reasons for this are most of them obvious, the Franklin Institute has appointed a committee to investigate and report on the subject, that the exact truth may be known, and the waste of time and talent likely otherwise to be experienced, be saved to the country.

TRIGONOMETRICAL PROBLEM AND SOLUTION.

Sir,—There is a well-known case in plane trigonometry—when two sides and the contained angle are given, the third side *only* is required. The following method (which is new, as far as I know) will be found to be easier, and at the same time the side required will be found more accurately, than by the common method of finding it by means of an auxiliary angle, &c.

Let a and b be the two given sides, C the included angle; and let it be required to find c the side opposite to the given angle C.

Assume $\frac{a+b}{2} = s$, then $\frac{a+b+c}{2} = s + \frac{c}{2}$ and $\frac{a+b-c}{2} = s - \frac{c}{2}$ then form a well-known theorem, $\text{Cos.}^2\frac{C}{2} = \left(s+\frac{c}{2}\right)\left(s-\frac{c}{2}\right) \therefore \frac{c^2}{4} = s^2 - \text{Cos.}^2\frac{C}{2} a\,b$ hence $\frac{c}{2} = \sqrt{s^2 - \text{Cos.}^2\frac{C}{2} a\,b}$. Assume $\text{Cos.}^2\frac{C}{2}\, a\,b = d^2 \therefore \frac{c}{2} = \sqrt{s^2 - d^2} = \sqrt{(s+d).(s-d)}$ or

$$\text{Log.}\ \frac{c}{2} = \frac{1}{2}\left(\text{Log.}\ (s+d) + \text{Log.}\ (s-d)\right)$$

Example given $a = 562$, $b = 320$. $C = 128° .. 4'$ To find

$$s = 441 \text{ and } \frac{C}{2} = 64° .. 2'$$

Log. $\text{Cos.}\frac{C}{2}$	1.282648
Log. a + Log. b	5.254886
Log. d^2	4.537534
d .. 185.68 ..... Log.	2.268767
Log. $(s+d)$ = Log. 626.68	2.797046
Log. $(s-d)$ = Log. 255.32	2.407085
Log. $\frac{c^2}{4}$	5.204131
$\therefore \frac{c}{2}$ .. 400.005 ..... Log,	2.602065

$$\therefore c = 800.01$$

2nd Solution by means of an auxiliary angle:—

Since $\frac{c}{2} = \sqrt{s^2 - \text{Cos.}^2 \frac{C}{2} a b} = s \sqrt{1 - \frac{\text{Cos.}^2 \frac{C}{2} a b}{s^2}}$. Assume

$\frac{\text{Cos.}^2 \frac{b}{2} a b}{s^2} = \text{Sin. } \theta \therefore \frac{c}{2} = s \text{ Cos. } \theta$

Log. $\text{Cos.}^2 \frac{b}{2}$	19.282648
Log. a + Log. b	5.254886
Log. s^2 = Log 441 × 2	24.537534
	5.288878
Log. Sin. θ^2	19.248656
$\therefore \theta$ ..... 24° .. 54′ .. 2″	9.624328
Cos. .... 24 .. 54 .. 2 ..... Log...	9.957626
s = 441 ..... Log...	2.644439
$\frac{c}{2}$ ..... 400.005 ..... Log...	2.602065

$\therefore c = 800.01$.

The first method has two advantages over the second.

First, it is much easier to find the number answering to a given Log. than to find an arc answering to a given sine, where it must be taken out to seconds, and, if great accuracy is required, to the fraction of a second.

Second, if we should find a little more than the truth by the first method, then $s + d$ is a little too much, $\therefore s - d$ will be a little under the truth; so that $\sqrt{(s+d).(s-d)}$ will be very near the truth; for the same reason $\sqrt{(s+d)(s-d)}$ will be a near approximation when d is a little below the truth. But if the computed arc should be a little too much its cosine will be somewhat under the truth, $\therefore$ the value of c, will be too little; and, for the same reason, when the computed arc is too small, the value of c will be too great.

In order to test the accuracy of both methods, suppose $a = 50$, $b = 40$, C = 120°.

The angle C being $\frac{2}{3}$ of two right angles: form a well-known Theorem $c = \sqrt{a^2 + b^2 + a b} = \sqrt{6100} = 78.1025$, and computing d from the first method, it will be 22.3606, from which we obtain $c = 78.1026$, and computing the arc θ by the second method, we find it to be 29° .. 47′ .. 42″ $\frac{1}{7}$, from which c = 78.1028. So that the error by the first method is only .0001, and by the second method .0003 in either method, had we computed c from tables extending to 7 decimal places instead of 6, the errors would have been only $\frac{1}{10}$ of the above.

I am, Sir, yours, &c.

GEORGE SCOTT,
Private Teacher of Mathematics.

11, York Buildings, New Road,
June 16th, 1839.

SOLUTION OF THE CAMBRIDGE PUMPING PROBLEM.

Sir,—I send you a solution of the Cambridge Problem, proposed in No. 826 of your scientific journal. I beg leave, however, in the first place, to notice that there is a mistake in the enunciation of the said question. It is stated that "a cubical foot contains $15\frac{5}{8}$ gallons;" this is not true, for a cubical foot only contains $6\frac{8\,5\,9}{1\,0\,0\,0}$ gallons. In the way the question is proposed, the cistern would hold 8000 gallons; supposing this to be the case, and that, instead of a cubical cistern 8 feet deep, let it be supposed that it is a prismatic cistern 8 feet deep, containing 8000 gallons, and "having an unknown leak," &c.

I remain, &c.

JOHN NELSON.

Solution.

70½ inches depth of water when the leak was stopt = 5875 gals. $\therefore$ 8000 − 5875 = 2125 gals. to be pumped in $\therefore$ 2125 × 2 = 4250 = number of gallons

A and B pumped in together at first ∴ 4250 — 4000 = 250, number of gallons leaked during the time that A and B first wrought together.

Let $2x$ = minutes they worked together at first, ∴ x = time they worked together at the last operation. ∴ $\frac{250}{2x} = \frac{125}{x}$ = number of gallons leaked per minute.

Also, 1½ inches depth contains 125 gals. ∴ $125 \times \frac{125}{x} = x$ = time B was bringing A up to work, and $2000 \div \frac{125}{x} = 16x$ = time B slept after A left off working; and $3x$ = whole time A and B worked together; hence $620 - (16x + 3x + x) = 620 - 20x$ is the time A and B worked alone: ⅓ of which, or $\frac{620 - 20x}{3}$ is the time A worked by himself, and $\frac{1240 - 40x}{3}$ = to the time B worked alone; therefore $2000 \div \left(\frac{620 - 20x}{3}\right) + \frac{125}{x}$ is the number of gallons A pumped in a minute, and $2000 \div \frac{1240 - 40x}{3} + \frac{125}{x}$ = number of gallons B pumped in the same time ∴ $\frac{450}{31 - x} + \frac{250}{x}$ = number of gallons A and B pumped together in one minute. But by the last condition $\frac{2125}{x}$ is the number of gallons A and B pumped together in one minute ∴ $\frac{450}{31 - x} + \frac{250}{x} = \frac{2125}{x}$ from which we obtain $x = 25$ minutes, and $\frac{125}{x} = 5$ gals. = the leakage per minute, and $2000 \div \frac{(620 - 20x)}{3} + \frac{125}{x} = 55$ gallons A pumped per minute, and $2000 \div \frac{(1240 - 40x)}{3} + \frac{125}{x} = 30$ gallons B pumped in the same time; also $\frac{620 - 20x}{3} = 40$ time A *worked alone, and* $\frac{1240 - 40x}{3} = 80$ time B worked alone. ∴ 85 is the number of gallons A and B pumped in one minute.

Hence,

$50 \times 55 = 2750$ pumped by A at first.
$40 \times 55 = 2200$ ——————— alone.
$25 \times 55 = 1375$ ——————— at last.

6325 gallons pumped by A altogether.

$50 \times 30 = 1500$
$80 \times 30 = 2400$
$25 \times 30 = 750$

4650 total gallons pumped by B.

J. N.

Paddington Street, June 14th, 1839.

MESSRS. LEPAGE'S BREECH LOADING GUN.

In the fire-arm department of the Parisian exhibition of manufactures, the object which excited the greatest attention was Messrs. Lepage's breech loading gun. In it the ordinary nipple for the percussion cap is dispensed with; and the action of bringing back the breech to its proper place after loading, cocks the hammer. Messrs. Lepage have patented their invention in England, in the name of M. Demondion, and from the specification enrolled (which is of great length) we gather the following particulars, which state the gist of the invention.

In the patent gun, the breech part of the barrel opens by raising a lever in the situation of the breech pin, which carries a part of the breech. When this lever, which turns upon joints in side plates, is raised, the breech end of the barrel is removed, and the cartridge may be introduced: when that is done, the lever is shut down upon the small of the gun, which closes the end of the barrel; and it is made fast by a spring catch in the end of the butt.

The cartridge is made up in the usual form, and the copper cap, containing the detonating composition, is inserted into the back end of it. On shutting down the breech pin lever, a solid piece of steel, as a small anvil, is brought close against the side of the detonating cap; an upstriking hammer, impelled by a strong spring placed against the guard,

when let off by the trigger, strikes the side of the detonating cap with sufficient force to crush it against the anvil, and thereby discharge the piece.

A beautiful specimen musket of this kind has lately been deposited in the Tower of London, a present from the French Government. On examining the collection of arms exhibited there, it will strike an observing visitor, that the idea of loading at the breech of the gun, is of very early origin. Some very ancient "breech pieces," as they are called, are shown, in which a portion of the gun at right angles with the bore is cut out—the charge is inserted in this moveable piece, which is then dropped into its place. This ancient plan has certainly the merit of great simplicity—we are not acquainted with the practical objections—probably the expansion of the metal by the heat acquired in firing, jammed the moveable charge piece.

MR. HANCOCK'S STEAM CARRIAGE PERFORMANCES.

Sir,—As an old inhabitant of Stratford, I have repeatedly noticed the performances of Mr. Walter Hancock, from the first of his experiments with his model carriage, fifteen or sixteen years ago—through his varied stages of improvement, up to his present state of perfection in steam locomotion on common roads; and I have also repeatedly read the puffs of others upon these matters which have issued from the press, most particularly of late. To your Magazine I can with some degree of confidence appeal for the insertion of the following brief statement of facts to which I was witness—never having before troubled you upon this subject.

Last Friday morning Mr. Hancock run his last built powerful carriage, the "Automaton," from his factory, through Ilford, and thence back through Stratford to the city, performing at the rate of 15 miles an hour. Meeting the procession of the Lord Mayor and other city authorities going to hold a Court of Conservancy at the Swan Inn, Stratford, he accompanied them to their destination, and in front, and in the neighbourhood of this house, under his direction the carriage performed a number of short trips, and masterly evolutions, *carrying at one time* no less than thirty-two of the gentlemen of the Conservancy jury and others, being ten more passengers than the number it is estimated to carry—quite to the satisfaction of every unprejudiced beholder or passenger.

How, then, Mr. Editor, is it, that with his years of experience and actual working, he is not taken by the public hand, in preference to sheer speculators—men who have no real claim to practical proficiency in this branch of science, but who, nevertheless, are obtruding themselves upon the notice, and claiming the support of the public.

The carriage on this occasion ran about 20 or 25 miles, without the most trifling accident or impediment.

I am, Sir,

Your very obedient servant,

JOHN BANTOCK.

Stratford Broadway, June 17, 1839.

MR. HAMPTON'S PARACHUTE DESCENT.

On Thursday the 13th instant, Mr. Hampton ascended in a balloon, from the grounds of Cremorne House, Battersea, and descended by means of a parachute in safety, alighting at Walham Green. The parachute used in the present instance (the second descent of Mr. Hampton) was entirely different from that of the unfortunate Mr. Cocking; it assimilated more to that of Garnerin. The upper part was in the form of an umbrella, about fifteen feet in diameter, and having an ornamented border. The radial ribs eight feet long, extend from the top of the parachute to its extremities, and formed of very thick whalebone, strongly fastened by brass clamps: the ribs were connected to the copper-tube by bamboo stretchers. At the ends of the ribs, curtains were suspended, 2½ feet deep. From his seat in the parachute, the aeronaut can by a rope which runs from the car to the curtains, either contract or expand them. The car of the parachute is strongly guarded by iron hoops. A pulley runs through the copper tube, (connecting the balloon to the parachute,) which opens a small valve in the balloon, by which gas may be allowed to escape immediately previous to descending. The rope which holds the parachute to the balloon is connected to it through the tube, which is 11 feet long.

Mr. Hampton's plan is, to open his parachute previously to separating it from the balloon;—then to let out so much gas that the balloon commences descending; he then cuts the connecting rope, and descends.

Were these ascents and descents made by way of experiment, with a view to testing any scientific fact, or for the investigation of any natural phenomenon, we of course could not properly object to them;—but made as mere exhibitions to gratify the excited appetites of a mob of gazers, we must cordially agree in the just condemnation given to them by the *Examiner*. The bravery, or temerity of Mr. Hampton, may perhaps excite admiration in some breasts, and in many pity; but the cold-blooded inhumanity of the brawling sight-seers cannot be otherwise regarded than with an unanimous feeling of detestation. We append the *Examiner's* remarks, interwoven with an account of the circumstances of the ascent and descent.

"The fate of Mr. Cocking is not forgotten by the public. He insisted on trying the mad experiment of a descent by a parachute which was obviously constructed on a false principle. Many attempts were made to dissuade him, and the most remarkable endeavour to that effect was on the part of one of the proprietors of Vauxhall Gardens, who assured Mr. Cocking that he was quite ready to incur all the damage of the riot which would be consequent on the disappointment of the public at Mr. Cocking's not risking his life according to engagement.

"Mr. Cocking could not think of preferring his life to the public gratification; and he gave the spectators, first, the pleasure of seeing the hazardous attempt, and secondly, the excitement of the catastrophe of his destruction.* * *

"The example has only produced imitators. A Mr. Hampton is the successor of Mr. Cocking, and as yet has not been dashed to a jelly, but no thanks to the public that such has not been his fate. The *Chronicle* gives this account of the mad experiment at Cermorne House on Thursday:—

"The balloon (the Albion) was fully inflated at half-past seven, soon after which time an announcement was made on the part of Mr. Hampton that the wind was blowing so strongly that *he would not be able to clear the trees*. This announcement *created great discontent, and symptoms of a general row were for some time apparent*. Many friends of Mr. Hampton endeavoured to dissuade him from the attempt, *but he seemed determined to risk his life* against all who cautioned him of *the probable consequences*.

"The car was then appended to the balloon, and with every prospect of the destruction of the fool-hardy man, what was the feeling of the public? Why, the *Chronicle* tells us that 'at this time the most intense interest was felt by all'—for the man? Oh, no!

"*Every one was crying out for the return of their money*, and it was promised that they should witness the ascent the next day; *but no one seemed inclind to agree to this*. Mr. Hampton was then seen to carry the parachute to the place where it was to be attached. He said, *whatever the result might be, he would deceive no one*. At about half-past eight the wicker car was attached to the balloon, and Mr. Hampton placed himself in it. The cords were cut; it was a moment of the most intense anxiety, and the balloon ascended with great rapidity; upwards it went, and in a few moments the parachute was separated; it was hanging in the air—*no one who was not present can tell the feelings of those who witnessed this;* the parachute *descended with frightful speed; a bag of sand was thrown out, and all believed it was Mr. Hampton;* the *frail machine collapsed and turned in all directions*. It was lost amid the trees, and for ten minutes the assemblage remained in harrowing suspense. A horseman was instantly sent off in the direction the balloon had taken, and until his return *no one dared to say 'the man will come here alive.'* At about twenty-five minutes before nine inmense cheering was heard in the King's road, and followed almost immediately by the appearance of Mr. Hampton. He had fallen on Mr. Propart's grounds at Walham green, and slightly injured himself by descending close to the side of one of the walls. When he arrived in the grounds of Cremorne House, he addressed the company present, and said he himself did not expect to return alive; for all the cords were tangled, and he could not tell whether he should have the slightest power over the parachute. Many cheers followed this address, and up to a very late hour the only topic along the line of road was 'the safe descent of Mr. Hampton.' It was commenced probably half a mile from the earth, in the midst of dense clouds.

"Now what is there in prize-fighting, or bull-baiting, more really savage than this, or betraying so much callous inhumanity in the spectators. Here was an immense throng of people whose pleasure consisted in seeing

a fellow creature risking his life with every probability of losing it, in a way the most horrible to the imagination. So much prepared for the event were they, that when the bag of sand fell to the ground they thought it was Mr. Hampton, and no doubt bets were laid whether it was the man or not. Before the mad attempt they had indeed cried out, but what was their cry? not forbear, but 'return us our money'—*our* money or *your* life."

WATER POWER IN MINES.

It is a very generally-received idea, that the steam engine has altogether superseded water power in mining operations. To show how extensively it is still used we extract from the "Statistics of the Fowey Consols Mine"—published in the *Mining Review* of April last, the following table of hydraulic engines and water wheels in use there. The total steam power in operation in the mine is 512 horses power—and of water power (adding the hydraulic engines and water wheels) 518 horses power—six more than the steam. The steam engine h. p. has been calculated according to Watt—but the engineers think it *ought* to be treble the amount stated.

Hydraulic-Engines in Fowey Consols Mine.

Designation and diameter of cylinder.	Horse-power.	Height of column of water.	Remarks.
Bottrall's..... 24-inches.....	49	..... 30 fms.....	Pumping-engine.
Union 22½-inches	52	..... 45 "	Ditto.
Total horse-power	101	.....	.....By water pressure.

Water-Wheels in Fowey Consols Mine.

Names of wheels.	Diameter of wheel. ft.	in.	Breadth of wheel. ft.	in.	Horse-power.
1. Union Wheel	34	0	4	6	52
2. Renfry's ditto.....	30	0	3	6	32
3. Old stamps ditto.....	19	0	4	0	22
4. Timber sawing ditto	27	0	2	6	18
5. Sampson's ditto.....	24	0	3	0	27
6. Old Grinder ditto	24	0	3	8	30
7. Separator ditto	24	0	1	9	15
8. Great Grinder ditto.....	27	6	6	0	60
9. Wheal Hope ditto.....	40	0	3	6	60
10. New Stamps ditto.....	30	4	6	0	65
11. Tremayne's ditto	24	0	4	0	27
12. Fitting up ditto	14	0	2	6	5
13. New Separator ditto	12	0	1	6	4
14. Total horse-power.....					417

Remarks.

1. Pumping-engine.
2. For drawing ores, &c., to surface.
3. For stamping halvans.
4. Using twelve verticle and circular saws.
5. For drawing ores, &c., to surface.
6. For crushing and pulverising ores.
7. For jigging or cleansing ores.
8. For stamping and pulverising ores.
9. For stamping halvans.
10. For ditto ditto.
11. For drawing ores, &c., to surface.
12. For turning lathes, boring, &c.
13. For jigging or cleansing ores.
14. By water wheels.

The total power by water now in use is equal to 518 horses, besides a spare fall of thirty-two feet for the whole stream, which would give upwards of sixty additional horse-power if required.

JENKS'S IMPROVED BREECH LOADING GUN.

The Committee on Science and the Arts, constituted by the Franklin Institute of the *State of Pennsylvania, for the promotion of* the mechanic arts, to whom was referred for examination an improvement in fire arms, invented by Mr. William Jenks, of Springfield,

Massachusetts, Report :—That the improvement consists of a piston or plunger, fitting in a chamber in the breech of the piece, which is drawn back by a lever and several pieces of metal, so as to permit the ball and charge of powder to be put into the chamber through an opening in the upper part of the breech. After which, the lever being depressed, the piston is forced forward by the above mentioned pieces of metal, which constitute, by their position, a species of toggle-joint. When the charge has thus been forced home, the joints are a little beyond a straight line, from the breech to the extreme point of action. It follows, as a necessary consequence, that the piston cannot be forced back by the discharge of the piece, and requires no fastening of any kind.

The Committee is of opinion that the invention of Mr. Jenks is a simple, safe, and efficient improvement in the construction of fire arms, that it presents very little difference to the eye, from guns of the ordinary construction, and is, as far as they perceive, free from all the objections which usually accompany breech loading, and possesses all its advantages.

ON THE EMPLOYMENT OF COKE FOR SMELTING PURPOSES IN BLAST FURNACES OF SMALL DIMENSIONS.—BY MR. SAUVAGE.

The experiments relative to the application of coke for smelting purposes have recently been made at the foundry at Champigneulle, near Grandpré, and the satisfactory results which have been obtained respecting the amount of consumption, are deserving of the attention of every iron-master in those neighbourhoods where wood is expensive.

The application of coke has frequently been tried elsewhere, at an earlier date, and the process has been adopted at Four-Chamboult, in the valley of Aubois. In fact, a mixture of coke and charcoal has been frequently used in different proportions. Coke alone has also been tried, and always with success. The furnace in which these experiments have been made is in the proportion of 8^m in height, and 2^m 15 in its greatest diameter.

The ore found in the neighbourhood is coarse, irregular grained, containing portions of translucent yellow and white quartz; it belongs, as is common with all in this district, to the lower portion of the cretaceous group. The beds are regularly deposited above the lower portion of the coral *rag, and in some places the* Kimmeridge clay. Below the iron beds are green sands, more or less argillaceous, covered with masses of argillaceous material.

The ore and green sands belong to the lower green sand, or Shanklin sand group—the upper clay to the gault; this last formation is covered by chlorite rock, soft and siliceous, and equivalent to the malm ; this formation extends over the whole of the environs of Vouziers ; towards the south-east it is again covered by the chalk marl. The spatangus, echinus, nautilus, terebratula, ostrea, and many other fossils, are found in this group—the analysis of the rock yielded—

Water	0·1440
Alumina	0·0340
Peroxide of Iron	0·5800
Chlorite	0·1766
Quartz	0·0348
	0·9694

and a trace of manganese.

The loss comprises a small amount of alkali contained in the chlorite.

The ore is mixed with a portion of the alluvion of the Aire as a flux; there are two varieties, the first calcareous, the other argillaceous ; the former only is used, and its analysis is—

Chalk	0·91
Carb. of magnesia	0·04
Clay	0.05
	1·00

Consumption in the Process of Smelting.

With Cold-blast.—For every 1000 killogrammes of metal, 2000 killogrammes of coal were used, not comprising the loss.

With Hot-air and Charcoal.—The temperature of the air was raised to 250° or 260°, the average of six months gave 1200 killogrammes of charcoal to 1000 killogrammes of metal, comprising the loss.

With Hot-air and a Mixture of Coke and Coal.—In April, 1838, a mixture of coal 904, and coke 434, was made, which gave 1338 killogrammes of the mixture to 1000 killogrammes of metal.

With Hot-air and Coke only.—The following are the results obtained :—The ore was weighed each time, and 105 killogrammes of coke were always added. The whole charge consisted of—

Mineral	154·00
Lime	15·52
Flux	25·00
Coke	105·00

In twelve hours twenty-one or twenty-two charges were made, and twelve charges of metal were smelted in the same time.

The result of four charges gave the following :—

May 31.—
One melting = 21 charges.
Weight of iron produced = 1552 killogrammes (*a*)
Two meltings = 21 charges.
Weight of iron produced = 1537 " (*b*)
June 1.—
One melting = 22 charges.
Weight of iron produced = 1650 " (*c*)
Two meltings = 22 charges.
Weight of iron produced = 1878 " (*d*)

The metal of (*a*) and (*b*) were of various tints, peculiar to the furnace.

The metal (*c*) was mixed.

The metal (*d*) was white.

The coke with which these experiments were made remained from a stock, and some portions were damp and of unequal size; some quantity was unusually small, so that, although the weight of each charge was the same, the quality of the material was different; and, as satisfactory as these results may have been, those made with more care cannot but be still more so.

The result of three other charges was as follows:—

Twenty charges = 1700 weight of metal.
Twenty-three ditto = 1625 "
Twenty-one ditto = 1700 "

The charge was always the same, and weighed each time — the metal was mixed. During the experiments the temperature of the blast varied from 280° to 300°. From the seven experiments, therefore, the average result proved 1000 killogrammes of metal to 1358 killogrammes of coke. It was interesting to compare the consumption of the blast-furnace, measuring 8m, with that of the large blast-furnaces of France and England.

The annexed are the relative results, extracted from a report of Messrs. Guenyneau and Dufrénoy, in a previous volume of the "Annales des Mines:"

Blast Furnaces.—France.

Isere.—Cold air, 2500 of coke; hot air, at a temperature of 334°, 1350 to 1400.

Ianon.—Hot air, 1200 to 1400.

Voulte.—Where common coke is employed—2100 to 2130 with cold air; with hot air, at 160°, 1200, 1250, to 1300 killogrammes.

Moselle.—1800 killogrammes.

England.

Clyde.—Hot air at 232° 20′—1900 killogrammes of coke.

Calder.—Hot air at 147° 3′—2140 coke; with cold air = 3000 killogrammes.

The result of one of the forges at Dudley is as under:—

With a temperature of the blast = 320°, 2700 killogrammes of coke were used to produce 1000 of metal; and with cold air blast 3000 *killogrammes were used.* The *dimensions of the furnace = 43 feet 6 in.—Annales des Mines, tom. xiv. (5.)*

NOTICE OF CERTAIN PRODUCTS OF ARTIFICIAL FUSION, ILLUSTRATIVE OF THE FORMATION OF VOLCANIC AND METAMORPHIC ROCKS. BY FREDERICK BURR.

[From the *Mining Review.*]

Although it must be acknowledged that the operations of the furnace afford only an imperfect index to what is passing at the base of volcanic orifices, and fulfil only a portion of the conditions which we may presume to exist there, much light has already been thrown upon the formation of igneous and metamorphic rocks, by attention to the products of artificial fusion, and further investigations of this subject may still continue to be productive of beneficial results. The following observations on the changes produced upon siliceous and alkaline matter by intense heat, have been made with a view of illustrating this curious subject.

The cone of a glass-house or a blast-furnace does not offer a bad illustration of volcanic action—various mineral substances are there exposed to an intense degree of heat, by which mutual decompositions are effected, the more volatile bodies driven off, and vitrification finally ensues. The substances thus acted upon are, as is well known, the same earths and alkalies, often too combined with iron, which form the principal constituents of volcanic rocks, to which the products themselves have occasionally much resemblance, although generally differing in assuming a state of more perfect vitrification than the former. In the case of obsidian, and occasionally also of pearlstone and pitchstone, we have, however, examples of natural vitrification by volcanic influence, almost as perfect as those which are furnished by art, and we may even trace its successive stages, as in the case of artificial fusion.

The manufacture of plate-glass, from the beauty and perfection of the substance produced, may be considered as offering one of the most interesting examples of artificial vitrification. This kind of glass consists of silica and soda combined, in the proportion of four parts of the former to one of the latter, and may, therefore, be considered as a silicate of soda. The union of these substances is effected by a very intense degree of heat (although produced without the aid of a blast), which is continued for about sixteen hours. Other substances, as lime, arsenic, and manganese, are in the first place mixed with the sand and alkali employed, in such manner and proportion as circumstances may require; but these ingredients, although essential to the process, do not enter into the permanent composition of the glass. Of the positive degree of heat given to the furnace, there is no means of forming an accurate judgment, but it is pro-

bably one of the most intense that has been used either in metallurgy or the arts.

I have before me a series of specimens, showing the different aspects which the mass of mineral substances above noticed assumes at different periods of the operation, and they will be found to offer some points of analogy with volcanic products, both in appearance and in composition. The different stages spoken of below are, of course, quite arbitrary, and merely the result of accidental samples taken at intervals during the process, yet, however, selected so as best to illustrate the changes effected by it.

In the first specimen, no trace of vitrification is perceptible—the grains of sand cohere together, so as to form a sort of artificial sandstone of a porous and cellular texture and rather crumbly in its nature. The colour is white, slightly tinged with purple here and there by the manganese, and the uncombined alkali runs through the mass, forming a slight efflorescence upon it.

In the second stage external vitrification has taken place, although a good deal of the alkaline sandstone is yet unconverted, and retains nearly the same characters described above. The vitrified portion has a pale amethystine tinge from the oxide of manganese, and exhibits innumerable white spots, arising from the unchanged silica, within it.

In the third stage the vitrification has advanced still further, but is still very imperfect. Both in colour and appearance the mass somewhat resembles rose quartz—it is but slightly translucent, and very heterogenous in its texture, a large portion of the silica evidently remaining uncombined with the alkaline matter, and therefore unchanged in its nature.

In the fourth stage the superfluous manganese has been volatilised, and the mass is thus perfectly white. Vitrification has advanced a good deal further than before, and the specimen appears, on examination, to consist of an imperfect glass, throughout which is disseminated perhaps twenty or thirty per cent. of devitrified matter, probably unchanged silica, and also a small portion of gaseous matter (volatilised alkali) in spherical globules. In this state, except in colour, the mass has a good deal of resemblance to certain obsidians, which exhibit, when in thin flakes, numerous opaque particles in a glassy translucent base.

In the fifth stage the combination of the silica and alkali has proceeded much further, the whole mass having been perfectly vitrified, and being tolerably transparent. *The sand is yet, however, imperfectly combined with the alkali, the vitreous portion being too highly charged with soda*, while the opaque particles, which prevent its perfect transparency, are scarcely combined at all. The aspect of the mass is, therefore, that of bad imperfect glass, slightly studded with impurities within.

In the sixth and last stage of the process the vitrification is quite perfect, no trace of uncombined material is now discernible, and we are presented with a perfect silicate of soda, brilliant, transparent, and homogenous, and only coloured in an exceedingly slight, and, indeed, almost imperceptible degree, by the unavoidable contact with metallic substances during the operation.

To attain this end is well known to be an exceedingly anxious and difficult task and there is probably no manufacture which requires such close attention and skilful management, throughout all its processes, in order to obtain a successful result. The last operation required previous to the mechanical after-processes, is the annealing, which is performed in low furnaces, so constructed that the intensely-heated vitreous matter may cool very gradually, thus admitting of that internal arrangement of its particles which is found essential to the perfection and quality of the article.

Any very striking resemblance between one of the most refined products of artificial vitrification, obtained by a skilful and nicely-balanced mixture of the purest silica with alkali and other ingredients, and the heterogenous vitrified products of volcanic action, cannot, of course, be expected, yet it will be seen that some analogies may still be traced, The agglutination of the grains of sand in the first stage of the process, is perhaps the first step by which Nature converts loose siliceous matter, when exposed to subterranean heat, into hard compact quartz rock. The appearance frequently observed in obsidian and pearlstone of opaque matter, included in a vitrified base, is strikingly similar, as before observed, to those stages wherein the unchanged silica appears disseminated in spots throughout an imperfect glass. Were any considerable quantity of iron present, to impart a greenish tinge and destroy the transparency of the mass, it is evident that the resemblance would be still more complete. The sixth stage would in this case much resemble the most perfectly vitrified obsidian.

In comparing the composition of volcanic products with that of artificial glass, and more especially the kind under consideration, two considerable points of difference will be seen, which doubtless prevent that close resemblance which might otherwise occasionally take place. In volcanic substances the quantity of alkaline matter is

usually in much smaller proportion, and hence the earthy matter cannot undergo such perfect vitrification as when this material is in excess. Iron is also present in considerable quantity, and hence the product is not only deeply coloured, but deprived of that translucency which it might otherwise possess. Many other points of difference, of course, exist, especially in the mode of cooling, but the above dissimilarities of composition are probably the most important.

PROBABLE EFFECTS OF STEAM IN FUTURE WARS.

(From Cooper's History of the American Navy.)

An opinion is becoming prevalent, that the use of steam will supersede the old mode of conducting naval warfare. Like most novel and bold propositions, this new doctrine has obtained advocates, who have yielded their convictions to the influence of their imaginations, rather than to the influence of reflection. That the use of steam will materially modify naval warfare, is probably true; but it cannot change its general character. No vessel can be built of sufficient force and size to transport a sufficiency of fuel, provisions, munitions of war and guns, to contend with even a heavy frigate, allowing the last to bring her broadside to bear. It may be questioned if the heaviest steam-vessel of war that exists could engage a modern two-decked ship even in a calm, since the latter, in addition to possessing much greater powers of endurance, could probably bring the most guns to bear in all possible positions. Shot-proof batteries might indeed be built, that, propelled by steam, would be exceedingly formidable for harbour defence, but it is illusory to suppose that vessels of that description can ever be made to cruise. Even in estimating the power of steam-vessels in calms, as opposed to single ships of no great force, there is much exaggeration, as historical facts will amply prove. The wars of this country afford several instances of frigates carrying eighteen pounders lying exposed to the cannonade of fifteen or twenty gun-boats for two or three hours; and yet in no instance has any such vessel been either captured or destroyed. It is a heavy sea-steamer that can bring six guns to bear at a time, and yet frigates have resisted twenty guns, advantageously placed, for hours. It may be said that steamers would dare to approach *nearer than gun-boats, and that by obtaining more favourable positions*, they will be so much the more formidable. There is but one position in which a ship can be assailed without the means of resistance, and that is directly ahead, and from a situation near by. Large ships can hardly be said to be defenceless even under these circumstances; as the slightest variation in their position would always admit of their bringing three or four heavy guns to bear. The expedients of seamen offer a variety of means of changing the direction of a ship's head in calms, even did not the sea itself perform that office for them. Nothing, for instance, would be easier than to rig, temporarily, wheels, to propelled by hand our of the stern or bow parts, or even on the quarter, that would bring a large ship's forward or after guns to bear, in a way to beat off or destroy a steamer.

There are certain great principles that are unchangeable, and which must prevail under all circumstances. Of this class is the well-established fact, that a ship which possesses the efficiency which is contained in the double power to annoy and to endure, must, in all ordinary circumstances, prevail over a ship that possesses but one of these advantages, and that too in a smaller degree. Steam may be, and most probably will be, made a powerful auxiliary of the present mode of naval warfare, but is by no means likely to supplant it. Fleets may be accompanied by steamers, but their warfare will be conducted by the present classes of heavy ships, since it is not possible to give sufficient powers of annoyance or endurance to vessels propelled by steam, to enable them to lie under the batteries of the latter. Even as active cruizers, the efficiency of steam vessels is probably overrated, on account of the consumption of fuel, though it remains to be proved by experience whether their employment may not induce a change in the armaments of light vessels of war. The history of the war of 1812 shows that ships have often cruized months without having fallen in with convoys, and it is certain that no steamer, in the present state of science, can remain at sea thirty days, with efficiency as a steamer.

In a word, while the introduction of steam into naval warfare will greatly modify maritime operations, it is by no means likely to effect the revolution that is supposed. In those portions of the art of seamanship that it will influence, steam will meet steam, and, in the end, it will be found that the force of fleets will be required in settling the interest of states, as to-day.

NOTES AND NOTICES.

Liquid Leather.—A Dr. Bernland, of Larria, in Germany, is said to have discovered a method of making leather out of certain refuse and waste animal substances. A manufactory of this nature has been established near Vienna. No part of the process is explained, only it is said that the substance is at one time in a complete state of fluidity, and may then be cast into shoes, boots, &c.—*Bristol Mirror.*

A New Method of presering Iron-work from Rust, communicated by M. Payman to the French Institute, consists in plunging the pieces to be preserved in a mixture of one part concentrated solution of impure soda (soda of commerce) and three parts water. Pieces of iron left for three months in this liquid had lost neither weight or polish; whilst similar pieces immersed for five days in simple water, were covered with rust.—*Liverpool Merc.*

Photography.—The *Literary Gazette* mentions, that M. Bonafons, of Turin, has found in a catalogue of old Italian works:—"Descrizione di un nuovo Modo di Transportare, qual si sia Figura Disegnata in Carta Mediantii Raggi Salari; di Antonio Cellio. Roma, 1686. In 4to. fig.—Thus truly verifying the old adage, "that there is nothing new under the sun."

Iron Sailing Ships—In noticing the return of the ship *Ironsides*, the Editor of the *Cornwall Gazette* makes the following remarks:—"This is a very important notice, and we commend it to the consideration of our commercial readers. In the adoption of iron ships several points are to be considered. Economy and durability, we suppose, are in their favour. Their sailing qualities seem by this experiment to be at least equal to those of wooden ships; but these depend less upon the material of which a vessel is built than upon her model. The thing that strikes us most, however, is the extreme buoyancy of the iron ship. She is said to be 264 tons—we presume by the new mode of admeasurement: if so, she carries probably 400 tons, and yet she draws only about eight and a half feet of water, or perhaps, with a heavier cargo, nine and a half feet or ten feet at the utmost! Now, the great drawback upon the profit of the coasting trade, at least in this part of England, is the impossibility of constructing a vessel that will carry a large cargo with a draft of water suitable to our tide harbours. A vessel of one hundred tons will draw as much water as this ship; and if the burden be carried up to 150 or 200 tons, the draft of water becomes a serious impediment, and what is gained in freight is lost in frequent and vexatious delays, and in injuries sustained from grounding on bars and sandbanks. But a vessel of 100 tons cannot be said in winter, and ought not to be sailed at any time, with fewer than four men and a boy; making for four such vessels twenty hands; while such a ship as the *Ironsides* might be sailed with twelve or fourteen hands at all seasons. But will an iron ship take the ground with a heavy cargo? That seems to us the principal question; and if it be found that she will—if it be found that a ship of large burden can be so constructed as to be fit for all the purposes of the coasting trade, and capable of enduring the severe trials to which the best and strongest ships are exposed in it, and yet so buoyant as to enter all the Welsh and Cornish ports, at neap tides—if this be ascertained, we may expect in a month or two, to see half the smiths of Hale and Neath turned into shipbuilders."

Powers of Machinery.—In one branch alone (the cotton trade) some spindles, which before the new improvements were projected used to revolve fifty times a minute, now perform six, seven, and in some cases 8000 revolutions in the same short space of time. In one establishment at Manchester there are 136,000 spindles kept in incessant motion by steam power, by which they are enabled to spin 1,200,000 miles (not yards) of cotton thread per week. The weekly produce of this article, when the machines are in full work, is about 400,000,000 of miles, or enough to encompass the earth 160 times.

Zinc Milk-Pails.—Among the patents lately taken out in America, one is for a process for extracting cream from milk by the use of zinc. It is said that if zinc be put into the milk-pail, or the milk be put into a vessel made of that substance, the same quantity of milk will yield a greater proportion of cream or butter.—*Repertory of Arts.*

Cornish High-pressure Expansive Condensing Steam Engine, at Carlisle.—[Abridged from the *Carlisle Journal.*]—On Saturday the 25th May, the engine, manufactured in Cornwall by Messrs. Harvey and Co., of Hayle, from the specifications and plans of Mr. William West, for the Carlisle Canal Company, commenced working. The Directors having assembled, the engine was started. This engine is set up for the purpose of supplying the Carlisle canal with water from the river Eden. The height the water has to be lifted is about 56 feet; the steam cylinder is 60 inches diameter; that of the pump 45; length of stroke 10 feet. In less than three minutes the water had been lifted to the pump head, whence it was poured forth in a continuous and rapid stream, at the rate of 6,624 gallons a minute: consequently, working at twelve strokes, the quantity delivered in twelve hours into the canal is 4,769,280 imperial gallons of water, equal to 763,200 cubic feet, and at an expense of fuel *under five shillings.* The canal from Carlisle to the Solway Frith is in length about twelve miles. In the course of a month, when "Harvey and West's New Patent Valves" shall be substituted for those now in use, the work will be done better, and with less friction, and the heavy blow and consequent vibration common to all pumping engines will be overcome. Mr. West's engine, at the Fowey Consols Mine, in Cornwall, on a trial lifted 125 millions of pounds weight, one foot high, with 94 lb. of coal, and averaged upwards of 90 millions during 12 consecutive months. At the Portsmouth and Farlington Waterworks the consumption has been reduced (doing more work) full 75 per cent. Mr. Wicksteed, the engineer of the East London Water Works, computes their saving at 70 per cent., viz.: 1,297*l.* 16s., instead of 4,328*l.* 2s.

Sir James Anderson's Steam-Carriage.—(From a Correspondent.)—Dublin, June 1.—I was much pleased at Sir James Anderson's steam-carriage, which I was lucky enough to get a sight of, owner and all, especially after all I have heard. It had just arrived from the country, and is destined for London in about three weeks or so. The engine itself, I suppose, weighs something like 10 ton, or even more; but being of 60 horse power will, I dare say, act very well. I shall, however, have no opportunity of judging that, as the tender is at Cork. It has a sort of diligence, not joined, but to be attached to the tender, making in all three carriages, so that the length of all will be 55 or 60 feet.—June 4, Censtoun, Wexford.—I mentioned Sir Jas. Anderson's steam-carriage as one of the many things I saw on Saturday. I talked a great deal about it to one of his principal men, who was most lavish in its praises, especially as regards the boiler.

The thirtieth Volume of the *Mechanics' Magazine* will be published on the 1st of July, illustrated with a splendid engraving of a LOCOMOTIVE ENGINE AND TENDER—the size of a sheet and a half of demy paper—exhibiting the whole of the machinery of the engine, and explaining its action.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough-court,* Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 829.] SATURDAY, JUNE 29, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

BUNNETT AND CORPE'S PATENT CONCENTRIC STEAM-ENGINE.

Fig. 1.

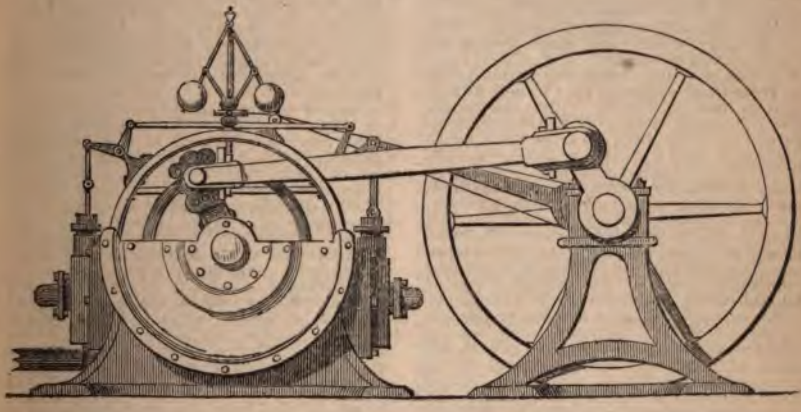


Fig. 2.

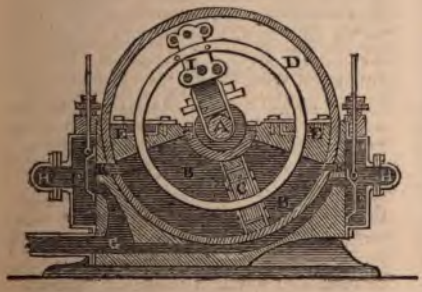
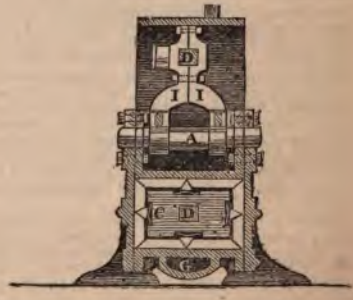


Fig. 3.



BUNNETT AND CORPE'S PATENT CONCENTRIC STEAM-ENGINE.

Sir,—A strong, and it would seem, not altogether groundless opinion, has hitherto prevailed, that considerable loss of power invariably takes place in the conversion of the alternating rectilinear motion of the piston-rod in steam-engines, into continuous circular motion by means of the crank. In consequence of the very general prevalence of that notion, ingenious men have long since turned their attention to discover, if possible, some method of accomplishing this object, which should be altogether unobjectionable.

The adoption of direct circular motion from the motive power of steam, seemed to offer an easy method of accomplishing what was sought for, and numberless schemes of this kind have from time to time been resorted to. Practical difficulties of an insurmountable character, however, have hitherto frustrated all the attempts that have been made, to produce a *rotatory* steam-engine exhibiting such decided superiority over its rivals of the rectilinear movement, as extensively to supplant them in the various occupations, for which steam power is conveniently and economically employed.

Numberless rotatory steam-engines, of different degrees of merit, are at this time at work in various parts of the country, but I am not aware of any one possessing such pre-eminent superiority, as to demonstrate that any particular advantage belongs to this mode of construction. Latterly, indeed, it would seem that rotatory steam-engines had fallen into considerable disrepute—possibly from the circumstance, that mathematicians have been somewhat industriously endeavouring to demonstrate the fallacy of ascribing any real utility to the continuous motion; at any rate, from this or some other operating cause, rotatory steam-engines, just now, if not at a discount, are certainly somewhat out of fashion. After the transcendant talents that have been brought to bear upon the question of the fallacy of rotatory engines, it would be presumption in me to attempt to argue the point at issue, for "who shall decide when *doctors* disagree;" but I may be permitted to bring before the notice of your readers a steam-engine of a novel and ingenious construction, which, by its extraordinary capabilities, seems calculated to furnish a problem of considerable importance to the scientific world.

I allude to the recently patented "Concentric Steam-engine" of Messrs. Bunnett and Corpe, the well-known patentees of the Revolving Iron Safety Shutters, described at page 178 of your 27th volume.

Without incurring any of the difficulties, or entailing any of the defects of *rotatory*-engines, the *Concentric-engine* seems to realise all the advantages that have hitherto been considered to belong to that form; while several advantages are obtained, scarcely to be expected in any other engine. By means of the accompanying engravings, I hope to be able to make the peculiar construction of Messrs. Bunnett and Corpe's engine perfectly intelligible to your readers.

Fig. 1 is the elevation of a high-pressure engine. Fig. 2 is a longitudinal section through the centre of the same. Fig. 3 is a transverse section. The same letters of reference apply to each.

This engine consists in the first place, of a circular case, in the centre of which is placed a fixed shaft A; the lower part being formed into a cylindrical arc or steam-chamber B, is fitted with a square or quadrangular piston C, upon the expanding principle originally patented by Barton. D is the piston-rod, of square steel formed into a ring, which passes through and is firmly attached to the piston C. This piston-rod works through two stuffing-boxes, furnished like the piston with metallic packings, and at a point exactly opposite to the piston is firmly embraced and supported by two arms I I, having a double bearing upon the fixed shaft A, on which they oscillate so as to allow the piston to reciprocate freely. E E is a portion of the solid casting of the cylinder, forming blockings for the attachment of the cylinder covers, and also carrying the metallic stuffing-boxes before alluded to. On either side of the steam-chamber, there are two distinct slide-valves F F., shown at one-third of the stroke; they take their motion from an eccentric on the crank-shaft, and have two distinct slide-boxes or covers, by which means no steam is lost in the passages. The exhaust-pipe is also fully open at the commencement of the stroke, and continues so to any

subsequent part of it that may be required. By this judicious system of valves, the steam can be worked either expansively to any extent, or not, at pleasure, without any tappets, cams or gear of any kind; the slides themselves cutting off the steam at any determinate part of the stroke; G is the exit-pipe for the waste steam; H H the steam-pipes to the two valves; K K are the steam ports. From one of the arms I (fig. 3) a pin projects, to which is attached the connecting-rod of the crank on the fly-wheel axle.

The action of this engine will be apparent on glancing at the drawings, but it may be briefly described as follows: The steam-valve being opened, and the exit-valve closed on the one side, and the opposite exit-valve opened, the steam drives the piston forward to the opposite side of the steam chamber, when the valves change their position and the steam is admitted on the opposite side, which gives a reverse motion to the piston, carrying it back to its original position. Thus, by the backward and forward movement of the piston, it passes twice through an arc of a circle, carrying with it the circular piston-rod, which by means of the horizontal connecting-rod, communicates motion by the crank, to the fly-wheel. It will be observed, that the connecting-rod has a direct action, without the intervention of guides or parallel motion of any kind whatever, and during the time that the greatest force is required upon the crank, never makes an angle of more than 5° to 10°, according to its length. The two arms I I. which embrace the piston-rod D, by spreading at the base where they are attached to the fixed central shaft, give stability and equalise the strain upon the piston-rod. The end of the connecting-rod in its reciprocating motion, describes an arc of a circle so nearly assimilating to the rotation of the crank, that the changes of motion are effected with surprising ease and rapidity, producing a smoothness and uniformity of speed, unattainable with any other form of engine. I have seen this engine, when unloaded, working at the rate of 250 to 260 strokes per minute without any perceptible *vibration* being felt on touching the machinery. The piston, *being suspended from, and* wholly carried by the arms I I, is relieved from all tendency to wear irregularly; there being, in fact, no pressure upon it beyond that of the springs necessary to keep the segments in their places.

Messrs. Bunnett and Corpe instituted a series of experiments, for the purpose of ascertaining with considerable accuracy the precise amount of mechanical advantage obtained by their arrangement of the piston, connecting-rod, and crank, as compared with the ordinary kinds of engines. For this purpose they took an iron rod corresponding to the piston-rod of a horizontal steam-engine, (as in locomotives) from which a connecting-rod passed on to the crank. The crank being placed at an angle of 5° above the horizontal line, a fourteen pound weight was attached to it. A line from the farther end of the piston-rod passed over a pulley, and weights were suspended until they were sufficient to move the crank upwards, which in this case was found to be 179 lbs. The crank was then placed at an angle of 10°, when the weight required to raise it was 96 lbs.; and so on, through the other points.

The same crank and connecting-rod was then attached to a piston-rod situated as in Messrs. Bunnet and Corpe's engine, and the experiments pursued as in the former case, all the results of which are shown in the following table, as also of a set of similar experiments performed with an unloaded crank. The coincidence throughout is strongly confirmatory of the accuracy of the experiments, and the average of the whole goes to demonstrate, that the power gained in the concentric steam-engine, upon mechanical principles alone, is full one-third more than is attainable in ordinary reciprocating engines.

Messrs. Bunnett and Corpe have an experimental engine erected at their manufactory, with a piston of 24 inches superfices, which, with a steam pressure of 20 lbs. on the square inch, drives the numerous lathes, drilling machines, &c. of their works. The patentees are about to apply this form of engine to locomotive purposes, for which, as well as for marine engines it seems particularly applicable. Indeed the compact form of this engine adapts it for all purposes, as the connecting rod can be attached to a shaft in any situation, no parallel motion being required. The principle of its moving power being that

Amount of Force required to move a crank having a nine-inch throw, through one-fourth of its revolution, commencing with an angle of five degrees from its dead centre.

With a fourteen pound weight suspended from the crank.				The same experiment with the crank not loaded.		
Degrees.	Old Principle.	New Principle.	Difference.	Old Principle.	New Principle.	Difference.
5	179	98	81	50	27.5	22.5
10	96	54	42	29	17.5	11.5
15	66	39.5	26.5	18.5	13.5	5.
20	53.5	34	19.5	14.5	10.75	3.75
25	40.75	29	11.75	12	9.75	2.25
30	33	26.5	6.5	10.5	8.5	2.—
35	29.5	23	6.5	9.25	7.75	1.5
40	24.75	21	3.75	8.25	7.	1.25
45	21	18.25	2.75	7.	6.5	.5
50	18.5	16	2.5	6.5	5.5	1.
55	16	14	2	5.75	4.75	1.
60	14	12	2	4.75	4.25	—.5
65	11.5	10	1.5	4.25	3.5	—.75
70	9.5	8.5	1	4.125	2.75	1.37
75	8.	7.25	.75	3.5	2.75	1.25
80	6.25	5.75	.5	3.25	1.75	1.5
85	4.75	4	.75	3.125	1	2.125
	632	420.75	211.25	202.25	134.5	67.75

of the balance, the amount of force applied to the piston is given out on the opposite side of the circular piston-rod—minus the slight friction of working through metallic packings. The concentric-engine offers the capability of increasing power to any required extent by adding to the *width* of the cylinder, without increasing the diameter, or by attaching the connecting-rod at any point between the piston-rod and centre of the engine. Engineers have always maintained the impossibility of working *square* pistons, but Messrs. Bunnett and Corpe have shown that no real difficulty exists to the efficient employment of this form, when judiciously applied. In their engine, they have also very ingeniously obviated the principal objection to all previous vibratory or rotatory engines—viz. the unequal wear of the radial piston, from the unequal velocity of its parts. In the concentric engine, the two curves of the steam-chamber, and consequently the velocities of the upper and lower segments of the piston differ so little from each other, that no perceptible difference of wear takes place.

Upon the whole, the concentric steam-engine may fairly be considered the *lion* of the mechanical world just now, and such of your readers as are fond of lionizing will avail themselves of the patentee's liberal permission to inspect the engine at their manufactory, near the Broadway, Deptford, and judge for themselves.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

London, June 5, 1839.

IRISH RAILWAYS.

Every enlightened well-wisher of Ireland must have seen, with feelings of *deep regret* and mortification, that Ministers *have abandoned* their long and *much talked of scheme, of* introducing a *general system of railways into* that kingdom, under the superintendence of government—abandoned it in the eleventh hour, after the expediency of it had received the solemn sanction of a vote of the House of Commons, and without any better reason being given for the aban-

donment, than that Ministers are afraid of pressing the House to carry their own resolution into effect! We cannot but view this as tantamount to an absolute denial to the sister kingdom, for a time, of the benefits of the railway system; for it has been shown incontrovertibly, in the course of the discussion which the subject has undergone, that without the aid of government on a large scale (involving of necessity government superintendance), there is not the least chance of more than two or three short detached lines of railway in parts of the country where there happens to be a superabundance of traffic, being accomplished for a long time to come by private enterprise. We are not friendly to government interference with public works, as a general system, but we are satisfied that under the peculiar circumstances of the sister kingdom, the interference of government to procure for her the benefits of a comprehensive system of railway communication would not only be wise and prudent, but is imperatively called for. Ministers have already interfered so far as to prove to all the world that private enterprise is wholly inadequate to a general introduction of railways into Ireland; and having done so, they were bound to take the one step further which the necessity of the case so manifestly suggests—namely, to get supplied from the public purse the funds which are wanted, under such guarantees for their proper expenditure as the public interest may demand. After what they have done they cannot, with any fairness, stop where they are; they must go on in the path which truth and sound policy has opened up to them, or be content to be regarded as a set of the greatest drivellers who were ever entrusted with the administration of the affairs of a great people. Following these remarks there is a very forcible letter, which Mr. James Pim, jun., of Dublin, has, on the spur of the moment, addressed to Mr. Frederick Shaw, M.P., on the subject. We differ from the writer on one or two minor points, but recommend his letter to the attention of our readers, as extremely well calculated, on the whole, to make its desired impression on the minds of the English public:—*

"In *attempting to discuss* the important problem of the best method of introducing a general and comprehensive system of railways into Ireland, it may be well, in the first instance, to consider some of the errors and disadvantages of the present system in England.

"I would wish, however, to state in the most distinct terms, that I do not impute any blame whatever to the individuals, professional or otherwise, by whom the railways have been constructed or managed. The evils are inseparable from the system, and I shall endeavour to point out one or two of the most striking of them by reference to those great lines with which I am best acquainted, namely, those by which Liverpool and Manchester are connected with the metropolis.

"The enormous parliamentary and law expenditure of these companies, in obtaining their several acts of incorporation, and in their subsequent applications to Parliament, is a matter of public notoriety.* Comparatively little, however, is known of the exactions to which they have submitted from landed proprietors and others in effecting their objects. The original surveys for those lines, although undertaken with the utmost zeal, and by parties of unquestionable talent and experience, were all too much hurried to meet the standing orders of Parliament, and their promoters had the mortification of knowing that vast improvements might have been effected, had they not been trammelled by the limits of parliamentary deviation.

"The consequence of all this, combined with other causes (and particularly the haste with which the works were prosecuted) has been, that the united expenditure of those three great companies has amounted to nine millions sterling.

"It is now admitted by competent persons, that if these lines were now to be made under the control and direction of a small united board of suitably qualified persons (to whom *as trustees for public accommodation* the legislature would grant ample powers, a line could be constructed, which would afford *at least* as much accommodation to the inhabitants

* *Letter to the Right Hon. Fred. Shaw, M.P. &c.*

* These expenses have amounted in some cases to as much as 2,000*l.* per mile, and I have it from good authority, that the average cost to railway companies has been 1,000*l.* per mile, wherever an opposition has arisen, whether well-founded or factitious. And this holds good for the only two Irish railways that were opposed, viz., the Dublin and Drogheda and the Dublin and Kingstown. See also Second Report of the Irish Railway Commissioners

of the intermediate districts, for less than six millions.

"Of the sums expended in round numbers, six millions have been raised by subscription, and three millions by loan, and the present premium on the shares is at least five and a-half millions, on which, as well as on the subscribed capital, the proprietors expect dividends at the rate of five per cent. per annum; and if I take the average rate of interest on the loans to be four and a-half per cent. per annum, the annual charge will be

Subscribed capital	£6,000,000	5 per cent.	£300,000
Premium on capital	5,500,000	5 per cent.	275,000
Loans	3,000,000	4½ per cent.	135,000
			£710,000

"Permit me to contrast this result with the previous assumption of an outlay of six millions, and that the state would only seek a return of three and a-half per cent. interest, and one and a-half per cent. for a sinking fund, the entire charge in the first instance would be only 300,000*l.* per annum; and after little more than thirty years, the public would have all the advantages of the railways for *the mere cost of working and maintenance.*

"Although the charge on the outlay in the two cases is represented by 710,000*l.* and 300,000*l.* per annum, the cost of working and maintenance will not be affected materially; as it has been ascertained on several railways, under extremely different circumstances, that this cost varies only between three-fifths and two-thirds of a penny, per passenger, per mile. I may therefore safely assume that the cost of transmission, both for passengers and goods, might have been reduced one-half in the first instance; besides a further extent of reduction in consequence of the increased numbers of passengers and increased quantity of goods, from the reduced charges;—it would at once have thrown open to agricultural produce the advantages of railway communication, from which it is now precluded by the present rates; an advantage which the Railway Commissioners have shown to be attainable on the Irish lines: and ultimately, instead of exacting the present high fares for travelling between London and Liverpool, the charges could have been reduced to 10*s.* for the poor man, and to *20s. for those who would pay for the luxury of better carriages.*

"With such results before us, would it not be almost criminal not to endeavour to secure to Ireland the advantages of a better system—in the poorer country too, where all our resources should be carefully economised?*

"Or, considering the question on grounds of public policy, is there any *disinterested* person who has paid any attention to it—is there any sound *statesman* who has ever given utterance to his opinion on the subject, but admits, that had the legislature been fully aware of the startling effect of the railway system, both for good and for evil, it would have long hesitated, at the period of the formation of those great corporations, to whom such vast powers have been entrusted, before they would have *given them possession of the great highways of the country.*

"I have heard it urged, from time to time, that Ireland is not yet sufficiently advanced for railways, and that we do not require them. On the contrary, I sincerely believe, that there is no country in which the results would be of greater importance, with a population, a large portion of whom are at the present moment on the verge of starvation; with a Poor Law about to be brought into operation, which threatens to reduce, to the lowest class, numerous bodies of the people, now but little raised above it; where upwards of four-fifths of the proposed outlay will be paid in wages to actual labourers, and where the results of the construction of the works will be to provide increased and increasing employment, by developing the vast resources with which Providence has blessed us. I look forward with, I trust, a well-grounded hope, to such a change in our moral and social condition, as will be a rich and an ample reward to those who may now exert themselves to promote this all-important measure.

"Railways have been one of the *consequences* of the commercial and manufacturing prosperity of England; in Ire-

* What says Mr. Henry Booth, the enlightened and intelligent Secretary of the Liverpool and Manchester Railway?—"In Ireland the position of things is different; but even there the contemplation of what is passing in England may not be without its lesson: for in all countries, and under all circumstances, it is an object worthy of a statesman, to prevent the reckless waste of the national means, and to give a right direction to the public expenditure."—Letter to Railway Commissioners, *Second Report.* (App. A. No. 9, p. 78.)

land, I trust they will be the *cause* of our regeneration; and if the character of our population be thus raised, see what a market is opened for British manufactures, and what facilities are given to the export of Irish produce.*

"I have, however, learned, and with extreme regret that the proposed government plan for the introduction of railways into Ireland, is unpopular *in England;* and that most persons consider the proposed advance as as an absolute grant.

"I am disposed to think that there is great want of information, much prejudice, and some misrepresentation to encounter; the large sums which have in various ways been squandered on railways, and on *schemes* for railways, must have found their way into some channels. The numerous class of men who have benefited by the present system are almost necessarily brought into close communication with members of Parliament, with landed proprietors, with capitalists, and with all who are interested in railways; and, without attributing anything like intentional misrepresentation, such are not the parties from whom information should be sought; and, on the other hand, few disinterested persons seem to take such an interest in the government plan as to induce any amount of personal exertion to promote it.

"Prejudice has been excited in the minds of very many well-intentioned persons, by attacks from the press, of a political and personal character, and with which, as I am not a politician, I have nothing to do.

"Any information which may be wanting I am most anxious to supply, and a portion may be now given after an Irish fashion, by telling you what we do *not* want.

"We *do not want a grant* of one farthing of English money. *Having no separate Exchequer of our own*, we ask for the aid of British credit, (or rather the *credit of the State*, and to which we are parties,) to enable us to raise the necessary funds, and, at the same time, offering unquestionably good security to protect the State against loss.

"The security proposed, in addition to the proceeds of the railway, is an assessment on property of vast extent and of immense value—a description of guarantee which those who understand the subject admit to be a perfect security. To the *granting* of such security, I admit, there are some objections, and particularly where the parties have no control over the expenditure of the funds or the management of the railways; but if the Irish representatives, convinced of the importance of the object to be attained—convinced also, that under suitable management it is scarcely possible but that the great lines of Irish communication will yield a far greater return than three and a-half per cent.—will consent, and almost unanimously, to this condition, it becomes extremely difficult to imagine any sound arguments against the *principle* of Lord Morpeth's plan.

"To a *detail* of the plan, as brought forward, there was an objection—it was proposed to commence with *one* line (to the south-west), and consequently *partially*; although I entertain no doubt whatever that the southern line was selected solely in consequence of its being probably more remunerative, and tending directly to make some of our south-western harbours available for facilitating British communication with almost every part of the world, and which latter object was one of the prominent features of the Irish Railway Commission.

"A modification of this plan, suggesting a triple line to the north, west, and south of Ireland, with a common entrance into Dublin, was some time since submitted by a deputation from Dublin, to a numerous and influential meeting of peers and members of Parliament connected with Ireland, and, as you are

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* The following comparative statement of our Imports and Exports in 1825 and 1835, extracted from the Commissioners' Report, will be read with much interest.

The amount of Exports was:—

		In 1825.	In 1835.
Cows and Oxen	in numb.	63,524	98,150
Sheep	in numb.	72,191	125,452
Swine	in numb.	65,919	376,191
Wheat	in qrs.	283,340	420,522
Barley	in qrs.	154,822	168,946
Oats	in qrs.	1,503,204	1,575,984
Meal and Flour	in cwts.	599,124	1,984,480
Butter	in cwts.	474,161	872,009
Bacon, Hams, Beef, &c.	in cwts.	966,531	749,283
Beer	in gallons	—	2,686,688
Linen	in yards	55,114,515	70,365,572

The amount of Imports was:—

		In 1825.	In 1835.
Cotton manufactures	in yards	4,996,885	14,172,000
Woollen manufactures	in yards	3,384,918	7,884,000
Tea	in lbs.	3,889,658	4,794,316
Coffee	in lbs.	335,921	1,205,762

aware, has received such an amount of support, that I can scarcely think Lord Morpeth will hesitate to adopt it, provided it shall be supported by the English Conservatives.

"But it is said, why not leave these works to private capital and enterprize, assisting them, if necessary, by loans from the State, or, in other words, *why not perpetuate in Ireland all the evils of the present English system*, and placing our highways under the control of parties who must necessarily and inevitably become monopolists, and over whom, after they have acquired a vested interest, the State can have no *effective* check? The State to be asked to advance one-half the cost by way of loan, having no other security than the competency of the parties to construct and manage the works, and the produce of their undertaking, if, successful; and all this for the benefit of the proprietors of the railway:—instead of a perfectly secured advance, to be expended under the control and direction of government, and *solely for the benefit of the State.*

"But I take leave to deny that even such an advance, by way of loan, could possibly effect more than the construction of one or two short lines out of Dublin, in the direction of the principal streams of traffic, just so much as in my opinion would prevent the introduction of any comprehensive system; one of the most important advantages of the government plan being that by *making the more profitable portions, pay for those which are less so*, the advantages of railway communication may ultimately be extended to the more remote districts, where, if the direct pecuniary returns may not be so great, other results may be looked for, well calculated to afford the highest gratification to the enlightened legislator and statesman.

"But the same parties who recommend that all should be left to private capital and enterprize, not unfrequently add, that they object to the interference of the State, "because railways can never pay in Ireland." It is not for me to reconcile the inconsistencies of their arguments, but merely to suggest, that under the circumstances I have already detailed, a railway might be eminently profitable in the hands of the State, and *with the same income be nearly ruinous to private parties. But if you can offer* capitalists the same advantages which the State would derive, namely, an absolute security of a return of 3½ per cent. under any circumstances, and *in addition*, the increase of customs and excise which could be fairly traced to have arisen from the railways—Could any prospectus be more tempting?

"I have already stated that I am not a politician — in truth, I have not had leisure to become one—the only political question on which I have ever felt strongly, and in support of which I have at any time taken an active part, arose out of my conviction of the value and importance of British connexion. Should, however, this question, this all-important *Irish* question, on the principle of which the Irish members of both Houses are nearly unanimous, be unfortunately rejected by a majority of *British* votes, I feel that it will give an argument to the advocates of Repeal, infinitely more popular than any they have heretofore been able to urge.

"I am bound to confess I did not always entertain the opinion that the State ought to undertake the construction of railways; my altered opinion has been the result of a long, patient, and disinterested investigation. Should I succeed in convincing you, as I have thoroughly succeeded in convincing myself, of the truth of all I have written, I shall have every hope of success for this great measure.

"You are placed in a position in reference to this question, by means of which you have eminently the power of repelling misrepresentation, dispelling prejudice, and of conveying information to the well-disposed; and if this letter can at all assist you, it will give me sincere pleasure, as a very humble labourer in one of the most important, if not *the* most important Irish *practical* question, that has ever been discussed within the walls of Parliament.

"Believe me,

"With unaffected respect and esteem,

"Your obliged and faithful

"JAMES PIM, Jun."

ON THE SUPPOSED LOSS OF POWER BY THE CRANK.

SIR,—In the recent communication by "M." respecting Mr. Sang's paper, "On the prevailing misconceptions concerning the action of machines," it is asserted that, "although the power is absolutely lost in the crank to the mechanist, nevertheless, it is only dissipated in some other direction and cannot be made available to him."

The law of virtual velocities is often admitted in cases where the spaces passed over, multiplied by the acting and retarding pressures, can be readily seen to be equal, allowing a slight preponderance to the acting force to overcome friction and maintain motion at some constant velocity. Where, however, there is a variable relation of the spaces passed over by the acting and retarding pressures, as in different parts of the ¼th revolution of the crank pin, and ½ stroke of the piston, the application of the law is not so apparent, and Mr. Sang's reference to a ratio of 100 to 1—crank pin to piston ½ space of motion—oversteps the limit of the popular investigation. For this question, the division of the quarter revolution, and half piston stroke, might be made into equal times of crank pins, and equal spaces of piston motion, and their separate relations in from 4 to 16 divisions would give an approximation close enough for practical purposes. But the party opposed does not seem to admit the law of virtual velocities, that the acting pressure impressed on the crank pin is decreased inversely as the space of motion.

At one time the duty of the Cornish pumping engines appeared to countenance the idea of loss of power in the cranked engines;—but lately these engines have reached 50 or 60 millions, in stamping ore, and have equalled the the simplest form of the application of steam power, in which the piston rod passes through the bottom of the cylinder —and is directly attached to the weights to be raised in a perpendicular shaft. The duty thus performed is still inferior to several of the large beam pumping engines—though not perhaps in a greater ratio than is due to the larger size, and greater amount of expansion of the latter.

The case is even stronger, since the circular *motion obtained by the* crank is *reconverted into a reciprocating* in lifting stamp heads to reduce the ore or tin stuff.

The limits of error in calculated duty are such as cannot materially affect the practical assertion of no loss of power in the crank; and it is sufficient to make it incumbent on parties who assert a loss of power to the mechanist, or dissipation in another direction (an idea equivalent to a waste of power) to show or attempt to show, the amount of the loss, and the direction in which it is dissipated.

It is by no means uncommon for mechanists to form extravagant notions of the defect or excess of the acting power. One cause is obvious; the practise of referring to the safety-valve load, rather than the indicator pressure in the cylinder. Errors due to this cause have been adopted in locomotives, while in steam boats the reverse system has been in use of underrating the neat acting steam power by a reference to the nominal horse power, arising from *engine friction allowances*, calculated for bad instead of for good engines; in numerous other cases difficulties occur in measuring the amount of the retarding pressure of the load or work to be done.

The expression "dissipation in another direction," seems to refer to the oblique action of the connection rod. Some slight increase of friction is caused by this on the crank pin in practise, which may be theoretically neglected by the assumption of an infinite length of connection rod.

Does not the crank question turn at times on verbal differences? The theorist speaks of power not being lost if accounted for by friction whether necessary or unnecessary. The mechanist considers unnecessary friction as a waste, equivalent to a loss of power. At the same time, does not the destructive effect of the rack and pinion prevent its use, and refute Mr. Sang's unqualified assertion, 'that the amount of friction is the only criterion for estimating the superiority of one contrivance over another? Even if qualified by the addition of "*other points being equal*," it has become a sort of paradox injurious to the cause, from its tending to produce misconception. Theorists ought to avoid such expressions in attempting to explain the application of the law of virtual velocities to the crank action, &c., &c.

I am, &c.

FALMOUTH.

THE CAMBRIDGE PUMPING QUESTION ARITHMETICAL SOLUTION.

SIR,—Since I sent you a solution of the Cambridge pumping question, proposed by your correspondent Mr. Pigg, I find that a solution of the said question may be obtained by common arithmetic, viz.—by the rule of single position, and as this solution will be readily understood by many of your readers who may happen to be unacquainted with algebra, I trust you will also give it a place in your scientific journal.

I remain, &c.

JOHN NELSON.

Paddington, June 25th, 1839.

Solution.—Suppose A and B worked at first 25 minutes $\therefore$ 4250 ÷ 25 = 170 gals. pumped by A and B in one minute including the leakage, and $\frac{4000}{25} = 160$ $\therefore$ 170—160 = 10 = leakage per minute. Now, had A and B worked separately for 1 minute, each 20 would be the leakage $\therefore$ 170—20 = 150 gals. But it is stated, that B had worked alone twice as long as A, and had only produced the same effect (abating the leakage) $\therefore \frac{2}{3}$ of 150 = 100 gals. pumped by A in 1 minute, consequently B pumped 50 gals. in the same time, and $\frac{2000}{100} = 20$ minutes time, A wrought alone, $\therefore$ B must have worked 40 minutes alone, also $\frac{2000}{10} =$ 200 minutes, B slept after A left off working, and 125 ÷ 10 = 12 ½ time B was in bringing A to work, also $\frac{2125}{170} =$ 12 ½ time A and B wrought together at the last operation $\therefore$ 25 × 20 × 40 × 200 × 12 ½ × 12 ½ = 310 minutes, the whole time elapsed, but by the question the whole time is 620 minutes $\therefore$

310 : 620 : 25 : 50

that is, A and B worked 50 minutes at first, and 40 and 80 are the respective times A and B worked alone, and 400 minutes B slept after A left off working, and 25 minutes is the time B was bringing A up to work, and $\frac{50}{2} = 25$ time they wrought together at the last operation $\therefore \frac{2000}{40} \times \frac{125}{25} = 55$ absolute *number of gallons* A pumped in 1 minute *and* $\frac{2000}{80} \times \frac{125}{25} = 30$ *gals.* B pumped in the same time, also 50 × 40 × 25 = 115 minutes A worked and 50 × 80 × 25 155 time B worked $\therefore$ 115 × 55 = 6325 gallons poured in by A and 155 × 30 = 4650 gallons poured in by B, the results being exactly the same as those obtained from algebra. J. N.

ROYAL INSTITUTION—MR. SNOW HARRIS'S LECTURE ON THE NATURE OF ELECTRICAL ATTRACTION.

May 31.—*The Conversazione.*—There were many interesting articles on the table, well worth the attention of visitors when made the subject of inspection, but confining our report as our practice has been, either to novelties, or to those things which excite an interest simply by their description, or merely by their announcement, we have only to notice on this occasion, a new Cupping apparatus by Mr. Hemming, and a specimen of the concentrated dye of Campeachy wood, proposed to be imported instead of the wood itself, by Mr. Hellyer. This appears to be a useful idea and is susceptible of other applications. We happen to know a case somewhat in point. The poorer copper ores in the island of Cuba, instead of being shipped for Swansea in their former gross state are now further sorted and separated, by which one half the freight is saved.

The Lecture.—Mr. Snow Harris lectured "On the nature of electrical attraction." This gentleman, as is well known, is distinguished for his experimental researches, and for his elegant skill in devising the beautiful apparatus, by means of which he has conducted them. It is principally adapted to the purpose of ascertaining in the most precise and unvarying manner, the exact quantitative measures of the electrical charge given to bodies, and the relations of the forces under varying circumstances, as expressed in weights. The first object is obtained, by having a unit measure in the form of a very small Leyden jar the electricity of which, when fully charged, passes by a spark to a very large jar in connection with the body to be electrified, the number of sparks determining the quantity. By this arrangement, the intensity of the charge is moderate, even when a considerable number of sparks have passed. The second object is obtained by means of a very delicate balance, having in place of one of the scale pans a piece of gilded wood, to constitute the attracted body, (which can be replaced by others of various shapes and sizes, according to the nature and purpose of the experimental inquiry,) beneath which, ad-

justable to any distance, is the body to be electrified, composed also of gilded wood of various shapes and sizes. The weights in the scale pan, determine the degree of attractive force, under the several circumstances of distance, size, shape, insulation, &c. There were modifications of this instrument, suited for special purposes, and also one on a different plan, but having the same object in view, in which an index, mounted on friction wheels, traverses a graduated arc, and has a pulley on its axis, round which is a silk thread, one end being attached to the body electrified by induction from the directly electrified body beneath, and the other end being connected to a counterpoise dipping into a glass of water. Thus the attractive force is estimated in this case by degrees instead of by weights, through the alteration of the buoyant force of the fluid exerted upon the counterpoise, as it is more or less immersed.

By means of this and other apparatus, which it would exceed our limits to describe, the lecturer performed many interesting experiments, some of a popular kind in order to illustrate a few elementary points; but the chief scientific object, was to show, in opposition to mere mathematical theories, that the law of electrical forces, varies according to circumstances; that it is as the inverse square of the distance only in the case of uninsulation, but when the attracted body is insulated, that it is simply as the inverse of the distance. This was shown, both by the different number of sparks required, and by the different weights required in the different cases, to produce an equilibrium between the forces of gravity and electricity. Hence the mathematical postulate that electrical forces, like that of gravity, radiate from a centre, is an unfounded assumption, resting on an analogy which the physical character of the phenomena do not countenance; for if such were the case, those forces would, by a kind of inherent necessity, follow the ratio of the surfaces related to that centre, and consequently act with an intensity proportioned to the inverse square of the distance. But the law as experimentally developed, being in a certain case simply as the inverse of the distance, the inference is, that electrical influence acts in parallel lines. This view is borne out by experiment, for if to the surface of the electrified body, is opposed a smaller surface in the attracted body, (of course both bodies are mutually attracted, but we use the term as distinctive of the one which is put in motion) the force of attraction will augment with every increase in the smaller surface until it attains *its maximum, which* will be, *when the two surfaces become equal, beyond which it will not be added to or diminished,* by any enlargement whatever of the non-electrified surface. This conclusion from the experiment is perceived with greater force, when it is considered that the attracted body is attracted solely in virtue of an opposite state of electricity residing over the whole of its under surface, induced in it by the directly electrified body. The inference is further confirmed by other experiments, touching the relation between spherical and plane surfaces; thus, to select one instance, the attractive force of two opposed spheres, is precisely the same as the influence of the two nearest hemispheres.

It is the peculiar reflex action of the induced electricity in the attracted and insulated body, which augmenting the totality of the force, produces also, as we understood the lecturer, that modification of the law as before stated, which obtains in this particular case. It was also shown, that the augmentation of the electrical force by induction, is in the ratio of the square of the quantity, or, the quantity being the same, that the force is doubled. The illustration of the latter fact by experiment, was exhibited by means of the second instrument before described. In connection with the electrified body, was a large circular disk, the communication with the machine being through the latter, underneath which, was a second insulated disk of the same size; this being withdrawn, the index showed a diminution of attraction force by one half. Mr. Harris also gave a few experiments which led him to believe in the materiality of electrical influence, and that it does not consist in molicular vibratory motion—one of which was, the uninterrupted energy of its propagation, which is exhibited in a conductor bent to a right angle. He also adverted to the fact, so contrary to received opinion, that he had been able to retain a charge on an electrified body in a vacuum for a considerable length of time.

Remarks.—We are sorry that we have been able to give only the above rather imperfect notice of this interesting lecture, so far at least as regards the precise details of the experiments, owing in a great measure to the lecturer having turned his back upon a part of the audience whilst performing them, (the instruments having been placed on the front of the table) so that situated as we were, neither seeing nor hearing fell to our lot. A reiteration of statements by the lecturer is also very desirable in certain cases. We hope, however, that we have not materially misunderstood him on any point, though we confess we do not perceive, how the *law* of electrical force is affected by any variation in the reflex action of induced electricity, the tendency of which would seem to operate only on its intensity. So

great a change in the law, points to its being of a secondary kind, resulting from different mechanical actions, dependent on essential differences in the physical circumstances of each case. The researches of Mr. Harris well deserve the attention of mathematical theorists; the discrepancies which he has brought to light, are not to be slighted and passed over as being merely apparent anomalies, arising from the complication of the mutual actions, and which theory could elucidate, even to the bringing out of the same results, if pursued into, and made to embrace all the minutiæ of the case. Mr. Harris does not belong to this self-sufficient *a priori* school, the old Aristotelian spirit of which is ill concealed by its mathematical guise, but he is a philosopher of the right stamp—cast in the true Baconian mould—one who being distrustful of the power of mere intellect to deal with the secrets of nature, is inclined to pay a greater deference to her teachings than to those of man; and who would sooner suspect the conclusions of theory, than even the slighter inferences from experimental investigations, and much less, those more legitimate inductions, which depend on and are guaranteed by varied attesting confirmations.

ON THE ATTRACTIVE FORCE OF A BLAST OF AIR.

When compressed air escapes through an orifice, a very singular phenomenon may be shown, which has not yet found its way into our books of science, although it is well known on the continent. This phenomenon can be exhibited by the following simple experiment:—

If we cut a couple of cards each into a disc of about two inches in diameter, and perforate one of these at the centre, and fix it on the top of a tube, such as the barrel of a common quill; then if we give the other card a little concave bend, and place it over the first, the orifice of the tube being thus directly under and almost in contact with the upper card; now, if we try to blow off the upper card, we shall find it impossible to be done.

This remarkable fact seems to have been noticed by several persons independently of each other. The French bring forward no less than three claimants, namely, M. Griffith, Mining Engineer of Fourchambault, and Messrs. Boigues of the same place, who showed the fact to Messrs. Thenard and Clement in September, 1826. About this time also the same fact appears to have *been noticed by Mr. Roberts,* an intelligent *manufacturer of Manchester.* We here give *the several accounts of the discovery.*

M. Griffith says that, if air be powerfully compressed in a resorvoir furnished with a circular opening in one of its vertical sides, and we present to the blast of air issuing therefrom a flat piece of board or metal, it will at first be repelled by the violence of the blast; but after forcing it nearer to the aperture, so as to overcome this repulsion, it will be powerfully attracted. In this position the air escapes by diverging between the interior surface of the board or metal, and the rim of the orifice.

The account of Messrs. Boigues is as follows:—A circular opening, one or two inches in diameter, being made in the flat side of a reservoir of compressed air, employed to feed a blast furnace, the air escapes with great violence; but, if we bring near to this opening a disc of wood or metal seven or eight inches in diameter, and having overcome the resistance caused at first by the blast upon the plane surface of the disc, the latter will no longer be repelled; it oscillates rapidly, at the same time receding from and approaching to the opening within very narrow limits. The air continues to escape with great noise between the surface of the disc, and that of the side of the vessel containing the air. If now we wish to withdraw the disc, it will require great muscular exertion to do so; and although the disc be not in actual contact with the side of the air-vessel, it seems as if glued to it.

The next discoverer of this phenomenon is our countryman, Mr. Roberts. Several years ago he had constructed an apparatus for ventilating his manufactory. A pipe, conveying a blast of air, terminated close to the wall of the principal apartment; and with a view to regulate the quantity of air to be introduced, he placed a valve over the terminus of the blast-pipe; but found, to his surprise, that the most powerful blast of air not only would not lift the valve, (which was merely a piece of flat board,) but that it even held the valve firmly down over the mouth of the pipe, so that the strength of one man was insufficient to withdraw it. This experiment has often been shown to visitors as one of the curiosities of Manchester.

This phenomenon can be produced by a blast of any kind of gas or vapour; by steam, and even by water, and other liquids.

The attractive force of a blast of air is particularly remarkable, if we place the card, mentioned at the beginning of this article, with its concave side upwards upon the table, and, with the tube in the mouth, hold the other card over it, and blow through the tube, when the concave card will start up from the table, and adhere to the other.

It has been stated, in reference to the experiment with the cards, that the upper card

cannot be blown off, because the current of air, which passes between the two cards in consequence of blowing through the tube, is in a more rarefied state than the atmosphere around and above; and that therefore the latter presses upon the two cards, so long as the blast is kept up and causes them to adhere.

But to show that the upper card is not retained in its place merely by atmospheric pressure, the following experiment was performed by Mr. Tomlinson. Let a brass tube, open at both ends, and terminated at the lower end by a perforated screw, be fixed to the table of the air-pump. A disc of card, two inches in diameter, is placed horizontally at the upper end of the tube. Another card of the same size, made slightly concave, is placed over the first. Let the whole be covered with a glass receiver: then let the air be removed, which of course can only quit the receiver, by passing out through the brass tube. When the exhaustion is carried to its utmost limit, let the air be readmitted in a full gush through the brass tube, and the upper card will *not* be blown off.

This experiment has been tried over many times, with various states of exhaustion, from a quarter of an inch of mercury to 20 inches; but in no case was the card blown off, or even agitated in the slightest degree: therefore the upper card is not retained in its position by the pressure of the atmosphere; but it is retained in its place from this circumstance, that when a fluid issues from an open tube, the lateral or side pressure of such fluid amounts to nothing. This is an extraordinary fact, and we will endeavour to make the proof of it as simple as possible.

It is a well-known property of fluids that they transmit their pressure equally in all directions; but this law applies only to fluids in a state of rest. When they are in motion they are subject to the laws which regulate the motions of solids, and do not transmit any lateral pressure, except when they meet obstacles to their onward motion. In proof of this conclusion we refer to an elegant experiment of Bossuet.

To a large reservoir of water a horizontal tube was attached, three feet in length, and three quarters of an inch in diameter, and about the middle of this tube was made a small lateral hole, for the formation of a *jet d'eau*, the pipe being so adjusted, that the hole might be directed upwards, downwards, or sideways, by merely turning the tube on its axis. The water in the reservoir was kept to the height of four feet above the tube; and the extreme end of the latter being *closed, the jet d'eau was immediately formed. When the hole was upwards,* the jet *rose very near to the surface of the* water in the reservoir. The jet was obtained in like manner, whichever way the hole was turned. The end of the tube was now opened, the water began to flow out at it, and the jet ceased almost entirely. It was only observed that, when the hole was turned below, the water escaped in drops. The cessation of the jet clearly proves the cessation of the pressure of the water against the sides of the tube.

The young student may perform a similar experiment by taking a tube, (such as a pea-shooter or a tube of paper will do,) and making a hole in the side. Then, if we put one end of this tube in the mouth, and stop up the other end, and blow, the air will rush out at the side-hole; but if we open the lower end, we shall, on blowing, be scarcely able to feel the air coming out from the side-hole. In the one case the air from the side-hole will blow out a candle; which it will not do when the tube is open at both ends.

The reason then why the upper card cannot be blown off is this; the first impact of the blast tends, of course, by its momentum, to force off the upper card; and, if this be not done at once, the current of air spreads out into a film, and escapes at the circumference of the discs, and in so doing its motion is altogether lateral—the pressure of which, as we have seen, amounts to nothing: therefore the disc is not removed, because there is, in fact, no force to effect its removal.

This little experiment, trifling as it may appear, is, however, of first-rate importance, and may possibly serve to throw light upon some of the terrific explosions of steam-boilers. It is possible, under certain conditions, that the blast of steam which escapes at the safety-valve may become reduced to a thin film with a lateral motion, and consequently without pressure; so that the valve, instead of being lifted up, to allow a full and free vent to the steam, may become attracted, which attraction would increase with the elasticity of the steam, and so precipitate the danger which the valve was intended to counteract.

SECRETARYSHIP OF THE SOCIETY OF ARTS.

We are glad to observe that our valuable and much esteemed correspondent Mr. Baddeley has started as a candidate for the office of Secretary to the Society of Arts, vacant by the resignation of Mr. Arthur Aikin. We earnestly wish Mr. Baddeley success in his canvass, not merely for his own sake than for the sake of the society. A gentleman better qualified to discharge the various important

duties of the office the members could not easily meet with. To a passionate fondness for mechanical pursuits, and an extensive and intimate acquaintance with arts and manufactures—attested by a vast number of contributions to scientific literature during the last fifteen years, all of a highly practical and suggestive character, Mr. B. joins excellent habits of business, formed in some of the largest and most respectable manufacturing establishments in London, with which he has been connected, great energy of purpose, untiring industry, and unimpeachable propriety of conduct. The election takes place we believe in November next.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 25TH OF MAY AND THE 27TH OF JUNE, 1839.

[TO THE PATENTEES.—*We beg to intimate that we shall be happy to publish descriptions with engravings, where necessary, of any of these patented inventions, free of expense to the patentees, if they will favour us with a copy or abstract of their specifications,—accompanied with any remarks or accounts of experiments; subject, of course, to our revisal and approval.*—ED. M. M.]

Alexander Gordon, of Fludyer-street, Westminster, engineer, for an improved machine or apparatus for employing steam or other elastic fluid as a motive power. Patent sealed May 30; six months to specify.

William Armstrong, of Hawnes, near Ampthill, Bedford, farmer, for improvements in harrows. May 30; six months.

William Palmer, of Sutton-street, Clerkenwell, manufacturer, for improvements in lamps and in the manufacture of candles. June 1; six months.

Stephen Geary, of Hamilton-place, King's Cross, architect, for certain improvements in paving or covering streets, roads, or other ways. June 1; six months.

Josephine Julie Besnier de Bligney, of the Commercial Hotel, Leicester-street, Leicester-square, for improvements in umbrellas and parasols. June 3; six months.

John Bradford Furnival, of Street Ashton, Warwick, farmer, for improvements in apparatus or material to prevent persons sinking when in the water. June 4; six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements in the manufacture of soap by the application of materials not hitherto used for that purpose (a communication.) June 4; six months.

William Bates, of Leicester, manufacturer, for improvements in the process of finishing hosiery and other looped fabrics. June 4; six months.

Christopher Nickels, of Guildford-street, gentleman, and John Danforth Greenwood, of the Belvidere Road, manufacturer, both in Lambeth, for improvements in producing plain and ornamental articles and surfaces, from cements or earths, separately or combined with other materials. June 4; six months.

Joshua Procter Westhead, of Manchester, for an improvement or improvements in the manufacture or construction of stays or corsets. June 4; six months.

William Prior, of Royal-street, in the Borough of Lambeth, gentleman, for certain improvements in the carriages and axle-trees of wheel-carriages. *June 6; six months.*

Arthur Parsey, of the Quadrant, Regent-street, rtist, for improvements in obtaining motive power. *une 6; six months.*

Harrison Grey Dyar, of Regent-street, gentleman, and John Chisholm, of Pomeroy-street, Old Kent Road, manufacturing chemist, for improvements in obtaining sulphur from pyrites, or certain native sulphurets. June 6; six months.

Charles Andrew Caldwell, of Audley-square, Esq., for improvements in furnaces and apparatus for applying the heat of fuel. June 6; six months.

Baron Henry de Bode, of Great Portland-street, Cavendish-square, for improvements in the means of rendering magnetic needles less prejudicially influenced by local attraction, which improvements are applicable to other magnetic objects for the same purpose. June 8; six months.

Francis Vouillon, of Princes-street, Hanover-square, for improvements in the manufacture of ornamental woven fabrics. June 8; six months.

Goldsworthy Gurney, of Bude, in the county of Cornwall, Esq., and Frederick Rixon, of Cockspur-street, Pall Mall, for improvements in the apparatus for producing and distributing light. June 8; six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements in printing calicoes and other fabrics (a communication.) June 11; six months.

Charles Chubb, of St. Paul's Churchyard, London, and Jeremiah Chubb, of Red Lion-street, Clerkenwell, mechanist, for improvements in apparatus and machinery for preserving books and other papers, documents, and articles from fire. June 11; six months.

William Hawes, of Old Barge House, Christ Church, soap-manufacturer, for improvements in the manufacture of soap, parts of which improvements are applicable to preparing tallow for the manufacture of candles. June 12; six months.

William Graunsell, of Louth, Lincoln, machine-maker, for improvements in apparatus for drilling corn, grain, pulse, and manure. June 12; six months.

Nicholas Harcey, of Hayle, Cornwall, and William West, of St. Blazey, in the same county, mechanist, for an improved valve for machines for raising water and other liquids. June 12; 2 months.

William Watson, of Temple-street, Dublin, gentleman, for an improvement in the construction of ships, and which improvement is also applicable to all kinds of sea-going vessels, and also certain improvements in the construction of boats and other vessels intended to be used on canals and inland navigation. June 12; six months.

William Newton, of Chancery-lane, civil engineer, for an improved medicinal compound, or ferruginous preparation, to give tone and vigour to the human system, particularly applicable in cases of weak digestion, and in the diseases called chlorosis. June 12; six months.

Joseph Sanders, of Burton-on-Trent, Stafford, gentleman, for an improved lock and key. June 12; two months.

Edward Loos, of Air-street, Piccadilly, chemist, for improvements in extracting the saccharine matters from sugar canes and other substances of a saccharine nature, which improvements are also applicable in extracting colouring matters from wood and other matters used in dyeing. June 17; six months.

Alexander Francis Campbell, of Great Plumstead, Norfolk, Esq., and Charles White, of the city of Norwich, mechanic, for improvements in ploughs, harrows, scarifiers, cultivators, and horse hoes. June 17; six months.

Richard Beard, of Egremont-place, New Road, gentleman, for improvements in printing calicoes and other fabrics. June 17; six months.

Bryan I. Auson Bronwick, of Clifton-on-Tone, gentleman, for improvements in machinery to be worked by the application of the expansive force of air or other elastic fluids to obtain motive power. June 17; six months.

Henrick Zander, of North-street, Sloane-street, gentleman, for improvements in steam engines, steam boilers, and condensers. June 17; six months.

Henry Le Messurier, of St. Peter port, Guernsey, master plumber, for improvements in pumps. June 17; six months.

John Lee Benham, of Wigmore-street, ironmonger, for an instrument or apparatus for correctly ascertaining the number of passengers conveyed in omnibuses and other public carriages. June 18; six months.

John Wright, of Park-place, Glasgow, for certain improvements in mixing or alloying iron with other metals for the purpose of increasing its strength, tenacity, or cohesion; which alloys, among many other uses, are particularly applicable to the construction or manufacture of links for chains and rings, and certain machinery for effecting such manufacture. June 18; six months.

Ambrose Bowden Johns, of Plymouth, artist, for improvements in colouring or painting walls and other surfaces, and preparing materials used for that purpose. June 19; six months.

Peter Lomax, of Bolton-le-Moors, weaver, for certain improvements in looms for weaving. June 19; six months.

John Werthermer, of West-street, Finsbury Circus, for certain improvements in preserving animal and vegetable substances and liquids. June 20; six months.

Charles Wye Williams, of Liverpool, gentleman, for certain improvements in boilers and furnaces, designed to economize fuel and heat. June 22; six months.

Henry Wilkinson, of Pall Mall, gun-maker, for an improvement in fire-arms. June 22; six months.

Joseph Pons, of Union Crescent, New Kent Road, for an improved process of hardening wood and iron, and rendering wood repulsive of vermin, and proof against dry rot. June 22; six months.

Matthew Punshon, of Norfolk-street, Blackwall, engineer, for an improved steam engine, certain parts of which improved steam engine are applicable to steam engines on the ordinary construction. June 22; six months.

George Calder, of Fen Court, Fenchurch-street, for certain improvements in stoves or apparatus for roasting, baking, or cooking, which he intends to denominate a "plantanum roaster." June 22; six months.

Frederick Parker, of New Gravel-lane, Shadwell, for improvements in revivifying or reburning animal charcoal. June 22; four months.

Wilton George Turner, of Park Village, Regent's Park, and **Herbert Minton**, of Longfield Cottage, Stoke-upon-Trent, Stafford, for an improved porcelain. June 22; six months.

Luke Hebert, of Birmingham, civil engineer, for apparatus for producing and communicating artificial light. June 22; six months.

John Alexander Phillip de Val Marino, of Margaret-street, Cavendish-square, for certain improvements in the manufacture of gas, and in the apparatus employed for consuming gas for the purpose of producing light. June 22; six months.

Edward Brown, of Whiterock, Glamorgan, copper smelter, for a new principle to be applied in the roasting and refining of copper, whereby the oxidation of the metal is reduced, and the same is rendered more pure and ductile. June 22; six months.

Joseph Jennings, of Besson Bridge, Cornwall, assay-master, for a process for obtaining metal from pyrites or mundic. June 22; six months.

William Vickers, of Twis Hill, Sheffield, steel manufacturer, for an improvement in the manufacture of cast steel. June 25; six months.

John Arrowsmith, of Bilston, Stafford, civil engineer, for certain improvements in steam engines. June 25; six months.

James Bingham, of Sheffield, manufacturer, and **John Amoins Boden**, of the same place, manufacturer, for certain *improved compositions* which are *made to resemble ivory, bone, horn, mother-of-pearl, and other substances, applicable* to the *manufacture of handles of knives, forks*, and razors, piano-forte keys, snuff-boxes, and various other articles. June 26; six months.

Claude Schroth, of Leicester-square, gentleman, for certain improvements in the process, manner, or method of embossing or producing raised figures, designs, or patterns on leather or such like materials, and in the manner or means used for effecting the same; also in the making or forming of certain tools or apparatus used therein. June 26; six months.

Pierre Auguste Ducote, of St. Martin's Lane, for certain improvements in the art of painting on paper, calicoes, silks, and other fabrics. June 26; six months.

William Newton, of Chancery Lane, civil engineer, for certain improvements in the construction of sun dials, designed to show mean time; a communication. June 27; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN 22nd MAY AND 22nd JUNE, 1839.

Joseph Amesbury, of Burton Crescent, Middlesex, surgeon, for a certain apparatus, or an improvement or improvements in apparatus for the support of the human body. Sealed 24th May, 1839; four months to specify.

John Henfrey, of Weymouth Terrace, Shoreditch, Middlesex, engineer and machinist, for certain improvements in the manufacture of hinges, or joints, and in the machinery employed therein. May 29.

John Boyd, of College-street, South, and **Hugh Francis Rennie**, of Glengall-street, both in the town of Belfast, flax spinners, for certain improvements upon the spinning frame used for spinning flax, hemp, and tow, upon the wet principle. May 29.

John Williamson Whittaker, of Bolton, joiner, and **Rowland Hall Heaton**, of the same place, cotton spinner, for certain improvements in the means of connecting, or uniting straps or bands for driving machinery and other similar purposes, and in the apparatus for effecting the same. May 30.

James Drew, of Manchester, civil engineer, for certain improvements in the means of consuming smoke and economising fuel in steam engines, or other furnaces, or fire places. May 31.

John George Bodmer, of Manchester, engineer, for certain improvements in the machinery, or apparatus for carding, drawing, roving and spinning cotton, wool, flax, silk, and other fibrous substances. June 5.

Edward Pearson Tee, of Barnsley, York, dyer and linen manufacturer, for improvements in weaving linen and other fabrics. June 6.

William Hickling Burnett, of Wharton-street, Bagnigge Wells Road, Middlesex, gentleman, for improved machinery for cutting or working wood. June 12.

John Roberts, of Manchester, machine maker, for certain improvements in machinery, or apparatus for planing or cutting metals. June 14.

George Nelson, of Leamington Priors, Warwick, gentleman, for a certain new or improved method, or new or improved methods of preparing gelatine, which has the properties of, or resembles glue. June 17.

William Morgan, of New Cross, Surrey, gent., for improvements in the generation of steam. June 17.

William Whittam, of Huddersfield, York, machinist for improvements in engines to be worked by steam, water, or other fluids. June 17.

Alexander Francis Campbell, of Great Plumstead, Norfolk, Esq., and **Charles White**, of Norwich, mechanic, for certain improvements on ploughs, harrows, scarifiers, cultivators, and horse hoes. June 17.

Charles Andrew Caldwell, of Audley-square, Middlesex, Esq., for improvements in furnaces, and apparatus for applying the heat of fuel, communicated by a foreigner residing abroad. June 18.

IRISH PATENTS GRANTED IN MAY, 1839.

R. T. Beck, new or improved apparatus or mechanism for obtaining power and motion, to be used as a mechanical agent generally, which he intends to denominate "Rotæ Vivæ." May 10.

J. Bourne, certain improvements in steam engines and in the construction of boilers, furnaces, and stoves. May 30.

J. Russell, certain improvements in manufacturing tubes for gas and other purposes. May 31.

NOTES AND NOTICES.

New Rotary Steam-Engine.—It is well known that repeated attempts have been made for a number of years to apply the power of steam in such a manner as to produce a direct rotary movement, without the intervention of cranks, or other complicated machinery; but, although many rotary engines have been constructed, none on trial has possessed such advantages over the engines in common use, as to lead to even a partial adoption; having been found deficient in power, and saving of fuel, though capable of great rapidity of motion. These difficulties have, we think, been most successfully overcome by Mr. Rowley, surgeon, R.N., who has invented a rotary engine, combining the advantages of simplicity of construction, with rapidity of motion, greater power than a common engine of the same size, and a saving of fuel of upwards of 20 per cent. One of six-horse power constructed upon these principles, by Messrs. Glasgow and Mayburn, of Trafford-street, and which has, for the last three months, been regularly working at the bed-ticking manufactory of Messrs. Johnson and Co., Garrat-road, has fully justified the most sanguine anticipations of the inventor. This engine consists of a circular steam-tight case, in which revolves a wheel of such a diameter as to leave a sufficient space round its circumference for the action of steam; this space being divided into two equal parts by a solid abutment, on the sides of which the induction and eduction pipes are placed. This wheel is fitted with two or three pistons, which work within the wheel, so as to pass the abutment, afterwards projecting into the steam chamber, and forming a resisting surface against which the steam acts, and consequently propels the wheel, the axis of which passes through the case, and is connected with the shafting of the machinery to be put in motion. Mr. Rowley has in progress of construction by the same engineers, upon the same principles, a railway locomotive engine, which will, we believe, be the first rotary engine applied to locomotive purposes, and which promises as successful a result as his first experiment. When we add to our account that the inventor intends applying the same principle to marine engines, we cannot hesitate in advancing the opinion, that Mr. Rowley's invention is calculated to form a new era in the history of the steam-engine.—*Manchester Chronicle.* [This paragraph has been handed to us by a gentleman of this town, who informs us he has seen the engine at work driving the machinery of the factory mentioned. He describes the cation of the engine as being beautiful in the extreme; no levers, beams, pistons, or cranks plunging about, but all smooth, circular, rapid, and noiseless.—*Liverpool Mercury.*

Opening of the Eastern Counties Railway.—A large concourse of persons assembled on June 18th at the temporary station, Devonshire-street, Mile-end, to witness the departure of the first train on this line of rail-road. Shortly after one o'clock the train started amidst the firing of guns and general acclamations of all present. The line commences at Shoreditch, on a viaduct about twenty-one feet above the level of the ground, up to which extensive and commodious carriage approaches will be made. At the commencement of the viaduct it is proposed to erect the London station, which will be of commensurate extent with the existing traffic. In it are several bridges, the arches of which are faced with stone, which gives them a handsome and imposing character, especially the bridge over Devonshire-street, the arch of which rises less, for the span, than we have observed on any other line of railway, the rise being less than one-tenth of the span. The line then passes over the Regent's Canal by an iron bridge, the general appearance of which has been much admired; two main ribs of iron, of fifty-four feet span, partly on the bow suspension principle, are thrown over the canal, to which transverse girders are fixed, supporting the roadway, on which are laid longitudinal sleepers of timber receiving the rail. An ornamental railing gives a finish to the whole. Passing successively over the River Lea, Grove Road, Coborn Road, Fairfield Place, and Old Ford Lane bridges, besides numerous other smaller archways, the railway passes over the Stratford marshes, within a few feet of one of the extensive reservoirs of the East London Waterworks. On this part of the line there are numerous bridges over the various streams and rivers which the railway intersects, some of which are of considerable magnitude, such as the Stratford viaduct of five arches, each of thirty-six feet span, the Mill-pond bridge of forty-six feet span, Kent's Mill bridge of four arches, and the Abbey River bridge, all of which are over tidal currents, besides numerous other small archways. The Stratford station is erected after the syle of a plain Italian villa, fitted up with waiting-rooms, carriage-shedding, engine-house, and repairing workshops for the engines. The depth of the cutting which immediately follows this station varies from ten to twenty feet. The public terminates at Barrack Lane, immediately adjacent to the town of Romford: the total distance is about ten miles and a half, which the trains will accomplish in less than half an hour. The engineer to the line is Mr. Braithwaite, to whom much praise is due for the generally efficient manner in which the works and engineering difficulties (not a few) have been executed.—*Times.*

Errata.—Sir,—When I sent you my last article on a new method of finding one side of a triangle, having given the other two sides and the included angle, I was on the eve of going into the country. It appears I must have committed some mistakes in my hurry of writing, which I trust you will correct; beginning with line 2, col. 2, which should have been as follows:—"By a well-known theorem we have $\text{Cos.}\frac{^2\text{C}}{2}\,ab = \left(s + \frac{c}{2}\right)\cdot\left(s - \frac{c}{2}\right)$ hence $\frac{c^2}{4} = s^2 - \text{Cos.}\frac{^2\text{C}}{2}\cdot ab$ therefore $\frac{c}{2} = \sqrt{s^2 - \text{Cos.}\frac{^2\text{C}}{2}\,a\,b}$. Again, p. 2, col. 1, line 27 from the bottom, for "if we should find a little more than the truth," *read* "if we should find *a* little more than the truth;" and throughout, for "these form a well-known theorem," *read* "by a well-known theorem."—I am, &c., GEO. SCOTT.

The thirtieth Volume of the *Mechanics' Magazine* is published, illustrated with a splendid Engraving of a LOCOMOTIVE ENGINE, on the scale of 1¼ inch to a foot—exhibiting the whole of the machinery of the engine, and explaining its action.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough-court,* Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

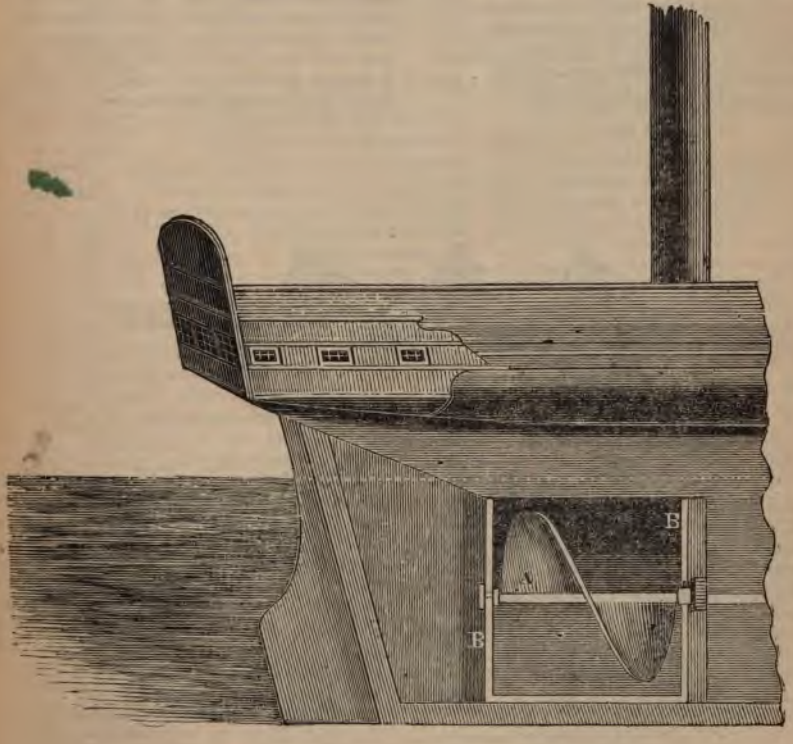
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 830.] SATURDAY, JULY 6, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

SMITH'S PATENT SCREW PROPELLER, AS FITTED TO THE "ARCHIMEDES" STEAM VESSEL.

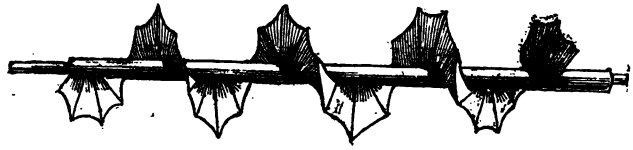


ON THE SCREW AS A MEANS OF PROPELLING VESSELS. — SMITH'S PATENT PROPELLER.

Attempts to improve the paddle-wheel of steam vessels seem how to be on the wane, and inventors are turning their attention to the powers of the screw. Archimedes by his screw raised water; *ergo*, say the moderns, the screw will, on motion being given to it, propel a vessel through water. The deduction is a fair one; but there follows another question: will it do so as efficiently, or as economically, as the paddle-wheel? We think that from reasoning and experiment we may safely answer in the negative. The screw has been repeatedly, during centuries past, tried as a medium of obtaining power from a fall of water, but has always been found to be inferior in power even to an undershot wheel. The same laws which govern this application of the screw, under nearly the same circumstances, equally apply to it as a propeller of bodies through water.

The idea of a screw propeller seems to have been formed very early in the history of steam navigation. We shall just refer to one or two instances which occur to us at present of its suggestion or trial. In the year 1819, Mr. Richard Whytock, of Edinburgh, contributed an article to the *Edinburgh Philosophical Journal*, descriptive of a new plan for working oars in steam-boats by machinery; appended to which is the account of a rude experiment made five or six years previously, with a boat to which he attached a screw, constructed in a rough manner. We extract the passage:—

"I have given a sketch of a screw which I constructed five or six years ago, with a view to a trial of its efficacy in propelling a vessel. Although I was prevented at that time from completing the experiment, enough was ascertained to warrant a trial upon a more expensive scale, as soon as time and opportunity should permit. The following is the way in which the screws that I used were constructed:—



"A cylinder of wood 6½ feet long, and 2½ inches thick, was divided by means of a cord in a spiral direction. The cord made 3½ turns in the length of the pole. The sole use of this cord was to show the direction of the spiral line, until it was marked out and pierced with a succession of holes, at distances of about two inches between each. Into these holes slender rods were fixed at right angles from the cylinder. The skeleton of the screw being thus formed, a piece of soft twine was fixed to the first of these rods, close to the pole, and carried to the second, around which it was made to turn once, and *then to the* third, and in like manner along *the whole of the rods.* Then it was brought *back in the same* manner in an opposite direction. *By repeating* this process, a web was formed from the cylinder to the points of the rods; and thus the form of the screw which I reckoned best adapted for the purpose was obtained. The rods being ten inches long, and the cylinder 6½ feet, and the screw consisting of 3½ turns, the mean angle at which the screw pressed upon the water was one of 45 degrees. Pitch was then applied, to give a solid body to the screw thus formed, and the web exactly resembled that of a duck's foot.

"Having obtained the measurement, and the exact shape of a boat which lay at one of the locks in the neighbourhood of Edinburgh, I had a frame made to support *two screws*, and of a shape and size to fit the boat; because, without getting a boat made for the purpose, I could not apply *one screw*

alone. As soon as the screws were let down into the water, and the boat was pushed off by means of the boat-hook, the upright handles, with which the screws were intended to be put in motion, began to turn round in the opposite direction; so that by this alone, the way in which they would operate became evident, although it was only the intended motion reversed. When force, however, was applied to turn round the handles, the breadth of the screws, and their too deep immersion in the water, rendered it necessary to apply a degree of pressure which did not consist with their delicate structure; and the bevelled wheels upon the axis of the cylinder not having been sufficiently fixed, gave way, and parted from the axle, which occasioned the experiment to be put off until they could be properly adjusted and made secure. Next day, however, I was denied the further use of the boat, and obliged to relinquish all further experiments with the same apparatus, as it was made to fit this particular boat only. Perhaps this description of the invention and experiment may induce some person in more favourable circumstances to give a full trial to this scheme."

We are not aware whether Mr. Whytock proceeded further in his experiments. If he did so, we are authorised to conclude that they were unfavourable. His original idea appears to have been to use one screw, as has been done lately. He was only compelled to the adoption of two by the circumstance of not having a boat suited to one. The main error in his project was the use of more than one turn to his screw.

The next instance we have to refer to, is a suggestion made by a correspondent of ours, who signed himself "J. Y." and a communication from whom was published in our second volume, p. 34 (1824), upon the application of the screw as a water power. At the conclusion of the article he says:—

"I have always been of opinion, that a wheel of this kind would be better adapted for steam-boats than the common paddle-wheels, for the following reasons."

Then follow a series of objections to the common wheel similar to those which have been reiterated from time to time by all new propeller inventors. He concludes:—

"Now all these bad qualities, I feel confident, would be very much mitigated by the *adoption of the spiral wheel.*"

Our intelligent correspondent and universal inventor, Colonel Maceroni, in the year 1827, submitted a plan of a screw propeller to the Lord High Admiral, the Duke of Clarence, (afterwards king,) and of which he favoured us with a description. For some reason or other which we cannot now call to mind, it was not published at the time. In reference to some experiments of Captain Ericsson with his propeller, detailed in our 807th number, he again addressed us on the subject; but as the communication was founded upon a mistake—Captain Ericsson's propeller not being a screw, and being totally different in principle and action, and perfectly unique in itself—we did not think it necessary to publish the Colonel's communication. From the subsequent circumstances we, however, now think it right to do so. It is as follows:—

"An interesting subject treated on in your 807th Number is *Captain Ericsson's Canal-boat Propeller*. Here is the copy of a letter addressed to me in June, 1827, by Admiral Sir Edward Owen, on the subject of the very same propeller, which I offered to the notice of the Lord High Admiral the Duke of Clarence.

"'Sir,—I have it in command from His Royal Highness the Lord High Admiral to thank you for your suggestions on the use of shells, projected horizontally, &c. * * *

"'With regard to your paddle-wheel and your ship propeller *on the principle of the screw*, His Royal Highness commands me to confer with you and report to him the result of the investigation, which, with much pleasure, will be given to those important subjects, by

"'Sir, your obedient humble servant,
(Signed) "'E. OWEN.'"

"I consequently waited on Sir E. Owen at the Admiralty with the models of my screw-propeller and paddle-wheel. The former he rejected at once, 'because the vessel could only be propelled thereby, the space analogous to the distance between the threads of a screw, at each revolution.' In vain did I predicate the *great velocity* that might be given by a steam engine to the shaft on which were fixed the blades or '*threads*,' at an angle of 30 or 40 degrees, &c. &c. As to the paddle-wheel he liked that much, but referred me to Sir Robert Seppings—who referred me to the Admiralty—which referred me back to the Navy Board—and then, at last, they said, that I, not being 'in the service,' must deposit.

500*l.* for the expences of making experiments. I told them that had I then had 500*l*, I would not have applied to them for any assistance. So the matter ended—with *me*. I still am the inventor and the possessor of the best *paddle-wheel* in the world, which one day must be adopted; whether during my existence, is another question. Having no patent for it, I cannot shew it to the public. *Requiescat in pace.*

"MACERONI."

The correct Tredgold, in his work on the Steam Engine, published in 1827, recommends the spiral propeller to the notice of his readers, after a series of calculations of its powers, as a method which may be used with considerable advantage. He appears to have been the first who notices the fact that very little additional power is obtained by using more than one turn of the screw, "because the water would have acquired all the velocity the spiral could communicate." He adds, "If it be continued, it should be made with a decreasing angle." This suggestion of Tredgold's seems to have been the foundation of the invention of Mr. Bennett Woodcroft, which we notice hereafter.

Amongst the *Patentees* of the screw for propelling vessels, are Mr. Bennett Woodcroft, Mr. Hale, of Greenwich, and Mr. T. P. Smith, a farmer of Suffolk. Upon the latter gentleman's plan have the most extensive experiments been made. We do not pretend to aver, that these are the only *re*-inventors and patentees of the screw propeller, but these are the only parties who have come prominently under the public eye.

Mr. Bennett Woodcroft obtained his patent in March, 1832, for a "revolving spiral paddle for propelling boats;" and which appears to have been founded on the suggestion thrown out by Tredgold, which we have referred to. In his specification he describes eleven different ways of applying the propeller, at the stem, stern, and sides of vessels, and claims them wherever placed; but he confines his claim to screws in which the pitch or inclination is continually increasing; the turns with the shortest pitch, or forming the greatest angle with the shaft, being next the head of the vessel, and lengthening towards the stern. One very ingenious modification is an arrangement of four screws, two working in *contrary directions to the others*, so that a column of water is forced from between them with a very certain force. It labours under the disadvantage, however, of complication, and would occupy too much room.

Although out of order we may here briefly mention the patent of Mr. Hale obtained in March, 1838. His plan is to inclose the screw in a case fitting nearly close to its edges. The circular motion given to the water by the action of the screw is immediately on its emerging from this case broken by projections, which we cannot describe without figures—but which, says the inventor, tend to keep the current in a rectilinear direction, notwithstanding the rotary action of the propeller.

We now come to the recent important trials of the powers of the screw propeller, which have been made on a scale of magnitude which will surely speedily set the question at rest.

In May, 1836, Mr. J. P. Smith obtained his patent, and in his specification, in the simple and honest belief, no doubt, of his perfect right so to do, claimed the screw altogether, and absolutely, as of his invention, for the purposes of propelling vessels, whether placed at the bows, at the stern, at the sides, or otherwise, however, applied to a vessel. A few months ago, however, he gave some appearace of validity to his patent, by disclaiming (under Lord Brougham's Act) all applications of the screw as a propeller, except as placed in the stern or dead wood of a vessel, confining his claim, in fact, to the exact arrangement which we shall now proceed to describe, and which is Mr. Smith's propeller as applied to the *Archimedes* steam vessel, built for the purpose of testing its powers, and of which so much has been said and rumoured in the steam-nautical world.

The engraving on our front page is a view of so much of the stern of the *Archimedes* (partly in section) as is necessary to exhibit the propeller. A A is the blade of the propeller being one turn of a screw, forming an angle of about 40 degrees with the shaft or axis; it is made of iron plates, strengthened by wrought-iron arms. B B is the frame fixed in the deadwood of the vessel to support the propeller. The shaft or axis passes through a stuffing-box in the after-part of the frame, and stern of the vessel, and onwards to the engine by

which it is made to revolve. For every revolution of the crank-shaft of the engine the screw turns about 5½ times. The screws are made moveable, and fixed on to the shaft with keys, so that different sizes may be used under different circumstances. The diameters of the screws which have been used are 5 feet, and 7 feet, and their lengths, 7½ feet and 8 feet.

The *Archimedes* was built by a company for the purpose of testing the invention; and we believe the chief promoters to be the Messrs. Rennie, and Messrs. Wright, the Bankers. A bill is now before Parliament to authorize a Company to purchase and hold the patent, and for other purposes; this is opposed by Mr. Woodcroft, on the ground (as stated in the "Objections to the Bill," which he has circulated) that it would prevent him reaping any advantage from his patented propeller, which he states has received the favourable testimonials of the Lords of the Admiralty.

A letter from Mr. George Rennie was published in a certain magazine, so prone to the circulation of falsehood, that had it not been authenticated with the signature of that talented engineer and gentleman, we should have passed it by as unworthy of notice. So authenticated, however, we are bound to give due weight to its statements, and shall be happy to receive any reply to the observations contained in the following article, which we have received from a correspondent, who has paid very close attention to the matter in question.

MR. SMITH'S SCREW PROPELLER.

The screw (erroneously called "Archimedes' Screw,") as constructed by Mr. Smith for propelling vessels has several great defects, which will altogether prevent it from competing with the common paddle-wheel both in point of utility and economy of power—indeed, if we except war-purposes, for which it is very essential that the propeller should be placed under water, regardless of an undue expenditure of power, we do not believe that it will ever be *practically* applied.

Any propelling apparatus to be practically useful must have for the basis of its construction such a principle, that the power applied to it will produce the greatest possible effect, attainable with reference to the specific gravity of the fluid in which it works; and it must also admit of considerable variation in the draught of water of the vessel to which it is applied: in both these principal features Mr. Smith's screw is quite defective. With regard to power and effect, there are three chief causes productive of much waste *besides* the loss produced by the receding of the water common to all modes of propelling, and which loss Mr. Smith admits to be in his screw equal to one-sixth of the force applied: that is the speed of the vessel to be $\frac{5}{6}$ths of the progressive speed of the screw.

The three causes alluded to consist of:

1st,—The friction or adhesion of the water occasioned by the enormous speed of the circumference of the screw or spiral blade.

2nd,—The unfavourable action of the blade towards the centre of motion where it becomes nearly parallel to the line of direction in which the ship moves.

3rd,—The frictions attending the complicated and cumbrous gear work resorted to in order to produce the requisite high velocityof the screw.

In order to give our readers an idea of the amount of power wasted by the excessive velocity of the spiral blade in going through the water, we will only suppose the slow speed 8½ knots attained by the "Archimedes," that is less than 10 statute miles per hour, we will say for round numbers 10 miles, or $10 \times 5280 = 52800$ feet per hour, or

$$\frac{52800}{60} = 880 \text{ feet per minute.}$$

Mr. George Rennie states in a letter which has been published, that two screws have been tried, one 7 feet in diameter and 8 feet long, the other being 6 feet diameter and 7 feet 6 inches long—the circumference of the latter requiring the least speed of the two, we will found our calculations thereupon.

The loss of speed being admitted to be one-sixth, it follows that for each revolution of the screw, the progress of the vessel will be $\frac{5 \times 7{,}5}{6} = 6{,}25$ feet; hence, the number of revolutions requisite to produce 10 miles an hour, or 880 f

per minute, will be $\frac{880}{6,25} = 140,8$. The diameter of the same being 6 feet, the circumference 18,85, and its length being 7,5 feet, with exactly *one turn*, it follows that the length of the circumference of the blade will be $\sqrt{18,85 \times 18,85 + 7,5 \times 7,5} = 20,3$ feet, this multiplied by the number of revolutions, gives $(140,8 \times 20,3) = 2858$ feet per minute or $\frac{2858}{60} = 47,6$ feet per second; hence, in order to propel the vessel at the rate of *only* 10 *miles* per hour, a velocity of upwards of 32 miles per hour must be given to the screw! That a large surface cannot be moved through water at such an enormous speed without much resistance any one will suppose, but the amount of the actual loss none of our readers would perhaps credit—we have, however, accurate data for forming an estimate by the known adhesion or friction of water against a given surface at a given speed.

Col. Beaufoy ascertained that a smooth surface containing 50 square feet met with the following resistance:—

at	3 feet per second	1,588 lb.
—	6 do.	do. 6,237 lb.
—	9 do.	do. 13,810 lb.
—	12 do.	do. 24,195 lb.

By inspecting these figures it becomes manifest that the resistances increase exactly as the square of the velocities, and therefore, when the resistance at 12 feet per second is 24,2 lb. it will be 380 lb. at 47,6 per second, or $\frac{380}{50} = 7,6$ lb. per square foot. Now in the screw under consideration it will be found that the mean of the friction or adhesion against *both sides* of the screw or blade will be very nearly equal to that offered to a surface of 40 square feet moving at equal velocity to the circumference; hence, $40 \times 7,6 = 30$ lb. will be the adhesive resistance at a velocity of 2858 ft. per minute, or $= 2858 \times 304 = 868832$ lb. varied one foot high in a minute, which is equal to $26\frac{3}{7}$ horses power absorbed without producing any useful effect. The power of the engine being 90 horses, and the loss produced by the receding of the water admitted to be $\frac{1}{6}$th, or 15 horses, it follows that $15 + 26 = 41$ horses *power are wasted, to say* nothing of *the loss occasioned by the* multiplying *gear, and by the unfavourable* action of *the screw or blade, towards* the centre before alluded to. Our readers will, after this demonstration, understand why the speed attained has only been $8\frac{1}{2}$ knots in open water with 90 horses power applied to a vessel of such beautiful lines as the *Archimedes*.

The lamentable consequences of the explosion of the *Archimedes*' boilers may also be traced to the cause we have now explained, viz. the great resistance produced by the excessive velocity of the screw—for had not this unlooked for resistance operated, the power of the *Archimedes*' engines would have been ample to give the required speed *without raising the steam in the boilers above the ordinary and safe pressure.*

Leaving the disproportion of *power expended* and *effect produced* out of question, and looking to the practical utility of the screw, it will become evident to any one, that for trading purposes, inland navigation in particular, the thing is useless in consequence of the impracticability of *always* keeping the *whole* of the screw under water. A canal-boat, for instance, will vary, according to the load, from 5 feet to 2 feet draught of water. In the latter case half the screw would be above water. That its effect then will be to swing the boat round as well as to propel needs no explanation, nor need it be stated that in such case the effect of the rudder would be of no avail against the force of the engine, to say nothing of the loss of power and speed occasioned by the position of the rudder, were it attempted to counteract the transverse motion produced in consequence of the lower portion of the screw being only immersed in the water.

Mr. Rennie, in recommending these propellers for "*war-purposes*," must have forgotten, that in addition to the circumstance of his boilers and engine being *several feet above water line*, and occupying the whole space up to the deck, he has cog-wheels actually placed 4 feet *above deck*; now the floats of the common paddle-wheel can bear half a dozen shot at least—not so Mr. Rennie's wooden tooth.

SCOBELL'S OSCILLATING STEAM ENGINE.

Sir,—Seeing in your last number an engraving and description of an oscillating engine patented by Messrs. Bunnett and Corpe, which in its principle and

application bears so near a resemblance to one made and set to work at this establishment, seven years ago, I think in justice to the inventor I cannot do better than send you the working model for your inspection, and I trust you may consider a description of it worthy a place in your highly useful journal.

The inventor and maker of the oscillating steam-engine, was an ingenious man named Henry Scobell, a native of Devonshire, and formerly a foreman of engineers at this place; the whole of the designs and drawings were prepared by him, and the engine made and set to work by his own hands, in the year 1831.

I am, Sir,

Your obedient servant,

SAMUEL SEAWARD.

Canal Iron Works, Limehouse, July 3rd, 1839.

[A description and engravings are in preparation, and will be published shortly, which will enable our readers to judge of the degree of similarity between Mr. Scobell's, and Messrs. Bunnett and Corpe's, Engines.]

OF THE MEANS BY WHICH IT HAS BEEN ALLEGED THAT WHOLE TOWNS, AND EVEN GREAT RANGES OF COUNTRY, MAY BE PRESERVED FROM THE INJURIOUS EFFECTS OF LIGHTNING. BY M. ARAGO.

[From the *Edinburgh Phil. Journal.*]

On the effects of Great Fires burning in the Open Air.—Certain experiments in natural philosophy, the analysis of which will afterwards be published, have led to the supposition that vast fires would conduct to the higher regions of the atmosphere, the greater part of the fulminating matter which is borne along by the clouds. These fires would thus become (such is the opinion of Volta for example) the best means of preventing thunder-storms, or of rendering them scarcely formidable. Let us now examine if observation can be brought to the support of these conjectures. I here lay entirely aside the absurd idea, that the sacrifices to heaven offered by the ancients, that all the flames ascending from the altars, and the black columns of smoke which, from the bodies of the victims, darkened the air —in short, that all the circumstances, and all the ceremonies intended, in vulgar apprehension, to disarm the thundering powers of Jove, constituted simple experiments in natural philosophy, of which the priests alone possessed the secret, and which had truly no other object than the enfeebling and even the gradual and complete destruction of storms. What I would here present is much less fabulous. I record, first, a fact which I owe to the kindness of M. Matteucci. There is a parish, near Cesena, in Romagna, of five or six miles in circumference, over the whole extent of which, in consequence of the advice of the curate, the peasants placed at intervals of fifty feet, heaps of straw and brush-wood. On the approach of a storm, all these heaps of straw, &c., are set on fire. This practice has now been had recourse to for three years; and during the whole of that time the parish has not suffered from a thunder-storm, nor has it suffered from hail, notwithstanding that formerly it used to do so every year, and within the specified period the neighbouring parishes have suffered from the meteor in the usual way. It must here be remarked, that three years do not form a period sufficiently long to enable us to pronounce definitely concerning the preserving power of these great fires. I must add, that the experiment is still in progress, and I shall not fail to give publicity to its result.

When I alluded, seven years ago, in the *éloge* of Volta, to the ideas of that illustrious philosopher concerning the advantage which might be derived from great flames during thunder-storms, "I conceived that we might obtain on this point some information, by comparing the meteorological observations made in those counties of England, where so many high furnaces and workshops transformed night and day into great oceans of fire, with the agricultural ones which surrounded them." This comparison has been made, and it has been found that the agricultural districts distinctly afford evidence of a larger number of such storms than the mineral ones; and yet I do not now think that the question is by any means settled. The great furnaces in England abound especially where there are many metallic mines; and the rare occurrence of thunder-storms in these localities may probably with more truth be ascribed to the *nature of the soil* than to the action of those enormous fires which the working of those minerals requires. In the year 1831, I had forgotten one side of the question.

In the experiment which is still going forward near Cesena, and in that of Cornwall, of which we have just been treating, the object is to appreciate the *simultaneous effect of a great number of fires*. As to a single fire, however considerable it may be, we can, I believe, prove that its action is insufficient to despoil of their fulminating matter even the clouds which are nearest to it, those in

fact which are immediately above it. Thus, we may instance what took place in the case of *l'hotel Montesson* at the end of the *rue du Mont Blanc*, which, on the 1st of July, 1810, was occupied by Prince Schwartzenberg. It was the evening of a *fête* given by the Austrian ambassador to Napoleon and the Empress Marie-Louise. In the middle of the night an immense ball-room was burned; and the vast columns of flame, over which the fire-engines had little control, did not ward off a tremendous thunder-storm which visited the immediate neighbourhood. The lightnings followed with frightful rapidity, and illuminated the whole firmament; the thunder rolled without intermission; finally, torrents of rain descended, which extinguished the last embers of the fire.

On the noise of Cannon as a means of dissipating Thunder-storms.—Mariners appear very generally persuaded that the noise of artillery dissipates thunder-clouds and even clouds of all kinds, although they cite few authentic facts in support of their opinion. The one most worthy of attention I have found on this interesting point is dated 1680, in the Memoirs of Comte de Forbin, which were published for the first time in the year 1729:—"During our sojourn," says this intrepid mariner, "upon these coasts (Carthagena on the Spanish Main), there arose daily, about four P.M., storms attended with lightning, and which, followed by tremendous thunders, always did some injury in the town over which they spent their fury. The Comte d'Estrée, to whom these coasts were not unknown, and who, in his different voyages to South America, had been more than once exposed to these kinds of hurricanes, had discovered the secret of dispelling them *by the firing of cannon*. He now tried the efficacy of his remedy against those thunder-storms, whereupon, the Spaniards perceiving and remarking that after the second or third discharge of the guns the storm entirely dispersed, struck with the prodigy, and not knowing to what to attribute it, testified great surprise mingled with fear."

In several countries the agricultural population, encouraged by the opinion of naval and military men, have had recourse to discharges of cannon when they imagined they were threatened by a thunder-storm, and more especially when it was accompanied with hail. We may first inquire when this practice took its rise. Without pretending to entire accuracy, I am led to suppose that it is not of very ancient date. In the first *Encyclopedie*, which was published in the year 1760, under the article *Orage*, by M. de Jaucourt, I find the following statements. "We have heard it more than once stated by our military men that the noise of cannon dissipates storms, and that it never hails in besieged towns." * * * "This effect of cannon is not altogether improbable; at all events there would be no harm in making a trial. A few hundred-weight of powder and the expense of carriage of some pieces of artillery, which would not be a whit the worse, would be all. *Perhaps* by this kind of undulatory motion thus excited in the air by the explosion of a number of cannon fired one after another, you might shake, divide, and dissipate the clouds which were beginning to ferment." It evidently appears from the whole of this passage, that in the year 1765 the use of cannons or of mortars *(boîtes à feu)*,* as means of dissipating thunder-storms, had not as yet become prevalent, and that authors still recommended it under the title of an important experiment. By the year 1769, another step had been taken. For in fact, I find in the eighth volume of the "*Histoire de l'air, et des Météores*," that in May 1769, the county De Chamb in Bavaria suffered from violent storms; that the fields were thereby ravaged with the exception of those "where the inhabitants *had introduced* the practice of firing a number of small cannon and mortars, so soon as they heard the thunder commencing."

It was the same year, 1769, that the Marquis des Chevriers, a naval officer, who had retired to his property of *Vaurenard (Mâconnais)* determined to meet the scourge of hail in the manner he had seen thunder-clouds at sea dispersed, as he supposed, viz., by the explosion of artillery; and in this way he annually consumed two or three hundred-weight of mining powder. The Marquis of Chevriers died about the year 1790, but the people in his neighbourhood, persuaded of the utility of the method he had employed, continued it. I find in a memoir which was drawn up in the vicinity by M. Leschevin, chief commissary for powder and saltpetre, that in the year 1806, cannon and mortars were in use in the following communes, viz., *Vaurenard*, *Iger*, *Aze*, *Romanèche*, *Julnat*, *Torrins*, *Pouilly*, *Fleury*, *Saint Sorlin*, *Viviers*, *Bouteaux*, &c. The commune of Fleury employed a mortar whose charge was one pound of powder; others employed mortars, larger or smaller, and it was usually from heights that these explosions were made; and the consumption of mining powder, for this purpose alone, was from nine to twelve hundred-weight a-year.

This process of the Marquis of Chevriers

* A sort of cast-iron mortar fired at rejoicings.—EDIT.

was not confined to the *Mâconnais*. Not long ago a mayor in the neighbourhood of Blois informed me, that in his commune, they likewise employed these mortars on the approach of thunder-storms, and he requested to know if science had conferred its approval upon the custom; a query which, by the way, I may remark, seems to show that usage had not completely demonstrated its utility.

The Bavarian or Maconnaise mode of dissipating thunder-storms has been hitherto based upon an *opinion* of mariners, and upon the solitary *observations* made in the seas off the Spanish Main; but in meteorology the experience of a few days is a very slender foundation for a general conclusion. In taxing my memory to try if I could not discover some fact which might support that one recorded by Forbin, I found one which was entirely opposed to it, and, which is somewhat remarkable, it also is derived from an admiral of the time of Louis XIV., and founded upon observations made upon the eastern shores of South America.

Come back then, in thought, to the month of September of the year 1711, and you may picture the squadron of Duguay-Trouin before Rio Janeiro. This fleet, composed of the following ships, *Le Lys*, *Le Magnanime*, *Le Brillant*, *L'Achille*, *Le Glorieux*, and *Le Mars*; also *L'Argonaute*, *L'Amazone*, *La Bellone* and *L'Aigle* frigates, and many other vessels of smaller dimensions, was employed the whole day of the 12th to force the entrance into the roads, defended by the formidable artillery of a great number of forts, and also by that of four ships and three frigates. The interval from the 12th to the 29th was occupied day and night in an unceasing contest of musketry and artillery. The galliots threw bombs, the Portuguese set fire to many mines, *blew up many of their ships*, burned many of their magazines, &c. &c. Finally, on the 20th, the day on which the place was taken, two of Duguay-Trouin's vessels, *Le Brillant* and *Le Mars*, the battery of the island of Chèvres, consisting of five mortars and eighteen twenty-four pounders, kept up a continual fire which overthrew a part of the entrenchments of the town; on the approach of night, upon a signal given by the commandant, there followed a general firing from the batteries and vessels, and notwithstanding, all this *did not hinder* the onset of a storm, accompanied, remarks the admiral, *with redoubled claps of fearful thunder and lightning, which succeeded each other with scarcely any interval*. Here, then, we have an *experiment*, in which are, assuredly, to be *found all the favourable conditions* possible, and notwithstanding, these many thousand detonations, infinitely more intense than those of the small cannon and mortars of the Mâconnais, *did not prevent the thunder storm from forming*, and when it was formed, *they did not disperse it*.

If a *single fact*, that borrowed from Forbin, has not, as it would appear, satisfactorily demonstrated that the reports of artillery have not the power of dissipating thunder-storms, it is as clear on the other hand, that the *isolated fact*, derived from the memoirs of Duguay-Trouin, does not prove the opposite position. It cannot, however, be questioned that those who have at their command the detailed annals of the late wars, will there find a multitude of documents more than sufficient to elucidate the question before us. I shall here repeat two facts which occur to my own memory, in the hope that they will lead to analogous statements. The 25th of August, 1806, being the day selected for the attack of the islet and fortress of Dannholm, near Stralsund, General Fririon, that he might harass and fatigue the Swedish garrison, ordered it to be cannonaded during the whole day. In spite of these powerful and continued discharges of artillery, a violent thunder storm visited the spot at nine o'clock in the evening. Again, it happened oddly enough, that the English line-of-battle-ship, the *Duke*, of 90 guns, was struck with lightning in the year 1793, whilst it was cannonading one of the batteries of Martinico.

Finally, I may here adduce another observation which, in default of more direct experiments, may not prove uninteresting. In the wood of Vincennes, at the distance of nearly two leagues from the observatory of Paris, there is a polygon fort where the artillery are in the habit of practising during certain months of the year. This fort is supplied with eight battering guns which fire point-blank, with four others for *ricochet* firing, with six mortars, and finally with a moveable battery of six guns. The practisings take place upon certain days of the week, from seven to ten o'clock in the morning; and the number of shots which are fired each day are about 150. As the reports are still very loud at the observatory, it appears to me that if they exercise upon the atmosphere that influence which so many people believe, the sky should be *more rarely overcast* on the days of practice than on the other days of the week; and this inquiry I have subjected to a minute investigation.

General Duchan, the commandant of the Vincennes school, has, at my request, kindly sent me an extract of the days on which the artillery practised, from the year 1816 to the year 1835. The total number of these days

amounts to 662. Again, the meteorological registers of the observatory furnish me, for each of these days of practice, with the state of the sky at nine o'clock in the morning. Of these 662 days, I find 158 during which the sky at nine A M. was completely obscured with clouds. I put, then, the question—*If the cannon had not fired, would the number have been greater?*

I believe it will be considered that I put the solution of this problem upon the fairest possible footing when I take for each preceding day, and for each succeeding the practice, the data of the observatory register already alluded to, and then take the mean of the two numbers as the normal meteorological state of the practice days. By this method we must be entirely free from all possible influence of the noise of the artillery. The following are the results:—

Of the 662 days before the practising days	.....	128 were cloudy.
.. 662 .. which were practising days	.....	158 .. ..
.. 662 .. succeeding the practising days	.....	146 .. ..

The mean of 128 and 146, viz. 137, is so much a smaller number than 158, that we might be tempted to conclude that the noise of the artillery, instead of dissipating and dispelling the clouds, actually condensed and retained them. But I know well that the numbers with which we have calculated are too few to allow us to draw any such conclusion. I shall only, then, affirm in regard to common clouds, that the discharge of the greatest guns appears to be wholly without influence.

Another problem, requiring fresh researches, suggests itself; and I will now take leave to recommend it to the attention of the superior officers at our artillery schools. Observations upon the state of the sky in these situations themselves, would be very valuable. Such as are made at the distance of from two to five miles, will be objected to by sceptical minds; and it will be alleged that such a meteorological station has become exclusively overcast, in consequence of that dispersion which the firing has effected in the zenith of the guns. It will be indispensable in this inquiry, to join with the observations of every practising day, those of the day previous, and the succeeding day, and the whole three must be taken very accurately, and at the same time. If the variations of the weather during the time that the firing lasted, were alone to be taken, we should evidently run the risk of attributing to the detonations of the artillery, the change in the appearance of the sky which almost every morning occurs in proportion as the sun rises above the horizon.*

Is it useful or dangerous to ring Great Bells during a Thunder Storm?—I proceed to examine this important question without regarding the unhesitating decisions of various learned bodies, whether executive or judicial,† and, at the same time, without any disposition to conclude that the widely-spread belief is not based upon a solid foundation. * * *

There is but a single step from the opinion we have just been discussing, and according to which, the noise of artillery may break up the clouds, may separate them into small groups, may, in fact, dissipate them, and rapidly transform the most threatening and darkest firmament into an azure sky, and the supposition that the same effects should result from the long-continued sounding of a great bell. But is it truly by this chain of ideas that mankind have been led to put the bells in noisy requisition, with the hope of thus dissipating an expected storm? I would the less venture to affirm this, since some antiquarian might perhaps discover that the practice of ringing these church bells is anterior to the invention of powder; and we shall be nearer the truth, I believe, if we look for the origin of this practice in various superstitious religious considerations. * * *

I shall borrow what may be most plausibly said in point of fact, concerning the danger which results from ringing the bell during a thunder storm, from an early volume of the *Mémoires de l'Académie des Sciences*. During the night between the 14th and 15th of April, 1718, in the space comprehended between Landerneau and St. Pol de Léon, in Brittany, the lightning fell upon twenty-four churches, and *precisely*, says Fontenelle, upon those where they rang the bells to disperse it. M. Deslandes, who transmitted

* Of the 662 days above referred to, there occur perfectly serene days on the day before the practice, . . 83
.. of 84
.. after 80

† In the year 1747, the Académie des Sciences itself regarded it dangerous to ring the bells, or to cause any other violent commotion in the air, when the storm was overheard. See *Hist. de l'Acad.* 1747, p. 52. A decree of the French Parliament, under date May 21, 1784, confirmed an ordinance of the Bailliwick of Langres, which expressly forbid the ringing of bells during a thunder-storm. Two years previously, a similar order had been issued in the Palatinate, by the Elector Charles Theodore. We might also cite mandates in virtue of which the same practice was proscribed over the extent of many dioceses.

the details to the Academy, adds—the neighbouring churches, where they did not ring, were spared. This observation has been reported in much too laconic a style; for it often happens that thunder-storms have a long and narrow course over a district, and it might have been so in Britanny. Again, with regard to the churches which were saved, were they not out of the direction pursued by the stormy clouds? In those belfries where they were ringing, the deaths and severe wounds which occurred among the ringers, clearly demonstrated the fall of the meteor; in other places, all the damage, consisting merely of slight fissures in the wall, or the fall of a little plaster, might be passed by without being noticed. Finally we ought, above all, to have been informed what were the comparative heights of those steeples which were struck, and of those that were unscathed. With all these uncertainties, the observation of M. Deslandes does not possess, it must be conceded, the character of a true demonstration; and science can designate only as a simple probability, the conclusion which has been drawn.*

An argument against the ringing of the bells during a thunder-storm was much insisted upon in the month of August, 1769, from the circumstance that lightning fell upon the steeple of Passy during the very time they were continuing to ring; but, all these things considered, it will be found that, throughout the long continuance of the storm, they rang with no less assiduity at Auteuil and at Chaillot, and, notwithstanding, the steeples of these two communes, between which the struck belfry of Passy stood, received no injury.†

In conclusion, we remark, that in the present state of the science, it is not *proved* that the ringing of bells renders strokes of lightning more imminently dangerous;—it is not *proved* that any great noise has ever made the lightning descend upon buildings, which would not, independently, have been struck by it. But, notwithstanding this, it ought most decidedly to be recommended that the bells should not be rung, for the sake of the ringers. The danger which they run is similar to that which those imprudent individuals expose themselves to, who, during a thunder storm, take refuge under a tree. Lightning strikes elevated objects, and especially the spires of steeples; the hempen cord attached to the bell, and commonly imbued with moisture, conducts the discharge to the very hands of the ringer, and hence so many deplorable accidents.* It should be remarked, that if the rope, whether wet or dry, does not touch the ground, which is generally the case, the fulminating matter, after it has reached the knot at its lower end, may, to a great extent, reascend it, may again reach the summit of the steeple, and then be dissipated in space. When this is considered, it will be seen, that we are not to conclude that because no damage has been done in the interior of a belfry, therefore the ringers would not have been killed.

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* The numerous and severe disasters of the 15th of April, 1718, did not at all injure the reputation of the bells in the estimation of the people in Lower Brittany. The 15th of April, 1718, was Good Friday, a day on which no bells should sound. Hence they contended there was no ground of astonishment, if those who, against a precept of their church, rang them, should be punished for their crime.

† In the year 1781, Abbé Needham of Brussels conceived that he had proved, by a cabinet experiment, that the ringing of bells is wholly inoperative, and does neither good nor harm. The detailed discussion of this experiment will naturally occur at a future time, when I shall examine all the analogies of lightning and of electricity. On the present occasion, I shall only add a few words by anticipation, that the reader may at least perceive the problem in all its aspects.

M. Needham constructed a model steeple in wood, three feet high, in which he suspended a *bell five and a half inches in diameter, and so arranged, that it might be rung by means of a handle. At the top of the steeple was placed a metallic ball, whose communication with the earth, or, in the* language of the natural philosophy of the day, with the *common reservoir*, was properly established. This ball was placed opposite a precisely similar ball, belonging to the conductor of an electric battery, which was charged to saturation. When the bell was not ringing, the explosive distance—the distance to which the spark darted, from the ball of the conductor to the ball of the steeple—was *a quarter* of an inch. The two balls were then placed at the distance *of half* an inch, when it was found that no spark was emitted, and there was no flow of the electric fluid between them, *although the bell was rung strongly and rapidly*. I look upon this experiment, says the Abbé, as decisive. All, however, will probably not be of this mind.

M. Needham having successively made the experiment when the two balls were at the distance of a quarter, and of half an inch from each other, would have been perfectly right in concluding, from these results, that the sounds of the bells did not considerably augment the facility of the electrical discharge, and that it did not *double* the explosive distance. But before he was authorized to affirm that the noise had absolutely no effect, I think he should have passed from the distance of a quarter to half an inch, not all at once, but by insensible degrees. Moreover, the small electrified masses —the two copper balls approximated to each other by M. Needham, were both *solid bodies*. In the atmosphere, on the contrary, we see floating clouds which the vibrations of the air may so far modify in their form, as sensibly to affect the electric tension of the surface which is turned towards the earth. The Abbé's experiment would have been very valuable had it given a positive result; but yielding only a negative one, it appears to me almost valueless in a meteorological point of view.

* To the unfortunate incidents already enumerated. I shall now add another, as these facts are the best means of curing the ringers of their hazardous folly. On the 31st of March 1768, the lightning having descended upon the steeple of Chabeuil, near Valence in Dauphiny, killed *two* young men who were engaged in pulling the rope together, and severely wounded nine others who were standing near them.

REPORT OF CAPTAIN PRINGLE, R. E., AND JOSIAH PARKES, ESQ., C. E., ON THE CAUSES AND MEANS OF PREVENTION OF STEAM-BOAT ACCIDENTS.

In consequence of the numerous communications made to the Government upon the frequency of steam-boat accidents, the Committee of Privy Council for Trade appointed Captain Pringle and Mr. Josiah Parkes, in January last, to investigate the subject. They proceeded by addressing circulars of "Queries" to Engineers, Ship-owners, and others connected with steam navigation; to Lloyd's Surveyors; and to Coroners. From the answers to these queries, from personal inspections and inquiries, and from other information, they came to the conclusions set forth in the following report. We have somewhat abridged the details, but have omitted nothing of importance. The appendix to the report contains some most valuable matter, which we shall transfer to our pages as opportunities offer.

Report, &c.

In the absence of any official record or registry of disasters peculiar to steam vessels, we could only have recourse to the knowledge and recollection of individuals, or to accounts given by newspapers (to trace the accuracy, or inaccuracy of whose statements would be an endless task); nor was it to be expected that the owners of steam-vessels would, very generally, volunteer a disclosure of the losses they have sustained. We, therefore, present this schedule as only an approximation to the real number of accidents; we trust, however, that it will be found sufficient to explain the principal causes of insecurity to travellers by steam-vessels, when coupled with the many excellent commentaries contained in the appendix.

The following is a numerical abstract of the schedule:—

Abstract of Ninety-two Accidents.

Vessels.		Ascertained Number of Lives lost.
40	Wrecked, foundered, or in imminent peril	308
23	Explosions of boilers	77
17	Fires from various causes	2
12	Collisions	66
92		453
	Computed number of persons lost on board the *Erin*, *Frolic*, and *Superb*	120
	From waterman's and coroners' list in the Thames, exclusive of the above, during the last three years	40
	From a list obtained in Scotland, exclusive of the above, being accidents in the Clyde during the last 10 years	21
		634

The greatest ascertained number of lives lost at any one time occurred by the wreck of the *Rothsay Castle*, when ..... 119 persons perished.
The greatest number at any one time from collision 62
The greatest number at any one time from explosion 24
The greatest number at any one time from fire 2

It thus appears that life and property, on board steam vessels, are endangered principally by liability to be *wrecked*, to *founder*, by *explosion* of boilers, by *fires*, and *collisions* with other vessels.

With the view of establishing and illustrating some of the more prominent causes of these disasters, we have brought together in the appendix a few well-authenticated cases, the following short notice of which, and others, will serve as a breviate of each class, and at the same time indicate some of *the practicable means of preventing* or *palliating similar accidents.*

Particular Instances of Accident.—Wrecks, Founderings, or imminent Peril.

Forfarshire.—The *Forfarshire* was wrecked September 7, 1838. The primary cause of this shipwreck was the defective state of one of the boilers; that its condition was well known to the owners and commander when she left Hull on her last voyage, and that its repair had been delayed. In her greatest peril she might possibly, and very probably, have been saved by her anchors—her hull being sound and good—but that the cables were foul, so that the anchors

could not be let go. Forty-five lives, at least, were lost.

Northern Yacht.—Respecting the *Northern Yacht*, which foundered on the 11th October, 1838, the circumstance of no inquest having been held, as no *body* was washed ashore, prevented that immediate and public disclosure of her unseaworthiness, which became known in the case of the *Forfarshire*, through the official interference of a coroner and jury.

The history of the *Northern Yacht* is the history of numerous steamers constructed or suitable only for river navigation, and afterwards put on sea service. Many of these are built, not to order, but *for sale;* they are purchased by companies or individuals ignorant of what a steam vessel *ought to be;* they are advertised in seductive terms, as "*Splendid new and powerful Steam Vessels,*" terms of which the public only discover the fallacy by some tragical event.

Killarney.—This is a case of total wreck, January 7, 1838, by which twenty-nine persons lost their lives. According to Mr. Harvey, she became unmanageable from carrying too heavy a deck-load of pigs, 600 in number, and shipping water. Some of the crew who were saved, and gave evidence on the coroner's inquest, stated that the fires had been put out by leakage from some defect in the boilers, or pipes of the engine, and that she had no sufficient sails to keep her before the wind. The pigs might have been thrown overboard, but the latter defects would be irremediable.

Aurora.—The case of the *Aurora* is a more uncommon one than either of the foregoing, being an instance of imminent danger to those on board an entirely new vessel, with new engines and boilers.

The account of the peril incurred by Mr. Macneill, civil engineer, and his fellow-passengers, on the 29th of January last, whose lives were only saved by Mr. Macneill's knowledge and determination, testifies in how imperfect a state the owners or agents of steam vessels will frequently send them to sea.

The *Aurora* was steaming in smooth water in the Lough of Belfast; yet she was in a condition to have been wrecked like the *Forfarshire*, or to have foundered like the *Northern Yacht*, had she reached the open sea.

This vessel belongs to a respectable company at Glasgow, who have some excellent steamers plying between that port and Liverpool. A letter in reply to our queries from the agent to this company contains the following observations:—"I cannot suggest any regulations which would give greater security to persons and property on board steamers. It is so strongly and obviously the interest of owners to procure and preserve for their vessels a good character, subjected as they are to so much competition as abounds in this country, that, taking an extended and general view of the subject, I believe no better security upon the whole can be afforded to the public than at present exists; and, in addition to this, it is also the interest of manufacturers of engines, for the sake of their own reputation, to see, as far as possible, justice done to their work by keeping it in good order," &c.

Mr. Macneill, however, from his professional experience, and the danger he had incurred, arrived at an opposite conclusion, and expresses himself as follows:—"I have no hesitation in giving it as my deliberate opinion, that this vessel would have been lost, and the lives of all on board sacrificed, had she reached the open sea; and I am also convinced, that had she been subjected to a proper trial and inspection by competent persons previously to her sailing, she would have been adjudged not seaworthy, and unfit to receive passengers and cargo for such a voyage. By such an inspection, the public would have been apprized of the true state of the vessel, and prevented exposing themselves or their property to such imminent danger. I therefore trust and hope that the Commission you are now appointed to, will lead to the establishment of some controlling inspection, which will for the future prevent the recurrence of such disgraceful transactions as the one I have mentioned, and be the means of saving both life and property."

Abbey.—This is the most flagrant instance of inefficiency and insecurity of hull, engine, and boilers, which it has been our duty to record; it exhibits also, if the statements of the crew are correct, incapacity and bad conduct on the part of the captain, who, though he had no passengers on board, was entrusted with the care of the vessel, with the lives of his crew, and with a considerable amount of property in cargo.

The expedients resorted to for diminishing or stopping the leakage of the boilers, would scarcely have been credited, had they not been substantiated by the evidence given; nor could we have ventured to state our own knowledge of the frequency of the practice of applying similar, and many other species of temporary *stop-gaps* to marine boilers, had not our assertion been corroborated by such facts as will be found in the evidence adduced on the cause of the loss of the *Abbey*.

Drunkenness and incapacity of the captain were proved, on the inquest, to have led to the loss of the Rothsay Castle: plugging

boilers with wedges of wood and white lead is shown to have been practised on board the *Northern Yacht*. In the *Abbey*, the leaks of the boilers were attempted to be stopped by mixtures of horse-dung, old ropes, and hemp, and she went to sea with numerous defects of hull, machinery, and equipment.

Four months previous to her wreck, which occurred on the 29th March last, she had been a passenger vessel between Leith and Newcastle, and it will be seen in how dangerous a predicament she had been placed before she was laid up. She was an old vessel, having been built in 1822.

Frolic.—This is a case of total wreck, in 1830. All on board perished; and, in the absence of any inquest or official record, the cause of her loss can now be but conjectural.

Rothsay Castle.—The *Rothsay Castle*, originally built as a river vessel, was put upon a *sea* station between Liverpool and Beaumaris for summer service; she was wrecked in 1831 on the Dutchman's Bank, about three miles from Puffin's Island, near Beaumaris; of 130 passengers on board, only 21 were saved.

The following note was handed in to the coroner by Sir R. W. Bulkeley, the foreman of the jury:—

"Sir,—From the evidence brought before them, the jury on this inquest cannot separate without expressing their firm conviction, that had the *Rothsay Castle* been a seaworthy vessel, this awful calamity might have been averted. They, therefore, cannot disguise their indignation at the conduct of those who could place such a vessel on this station, and under the conduct of a captain and mate who have been proved by the evidence before them to have been in a state of intoxication.

(Signed) "R. W. Bulkeley."

This disaster was chiefly the cause of the appointment of a Select Committee of the House of Commons in 1831, "to take into consideration the frequent calamities by steam navigation, and the best means of guarding against their recurrence."

Erin.—No authentic record exists of the specific cause of the foundering of this vessel in 1833; as no one of her unfortunate passengers or crew survived to tell the tale, and there was no official inquiry into her condition previous to her last voyage.

It appears that her engines had broken down, her boilers had given way, or she had shipped or leaked so much water as to extinguish the fires; her sails also were seen *blowing in ribbons*. The number of lives *lost was not ascertained.*

Messrs. Wilson, ship-builders, Liverpool, are disposed to ascribe her loss "in great measure to her breadth of sponsine, or overhanging of the sides; a mode of construction not now practised by judicious builders."

It may be here observed, that *river* steamers, which are often thus constructed for the sake of obtaining a great breadth of deck to carry passengers, are the most unworthy of *sea-boats*, and, as an old experienced seaman said to us, "are sure to become graves sooner or later."

Superb.—The *Superb* is supposed to have foundered in the North Sea in a severe storm in the month of October 1834; all hands on board perished.

Every effort was made by the General Steam Navigation Company, to whom she belonged, to ascertain the cause of this disaster, but no intelligence has been obtained. She is reported to have been in excellent condition, having been rebuilt by Messrs. Fletcher & Co. a short time previous, and also to have been fitted with new machinery.

Ardincaple.—The cause of danger to this vessel, in 1833, was a defective boiler. In 1835, whatever may have been the state of her boilers, it appears that from some cause the fires were extinguished; that the vessel became unmanageable, for want of sufficient sails; that her anchors became useless by the snapping of her chain-cables; and that she was saved, after losing her commander, and six other persons, by a *fishing-smack.*

Many disasters have arisen from all these defects combined in one vessel; but, unless an inquest be held from the washing up of bodies, the story of danger remains untold; or it is unheeded, or attributed to the weather, rather than to the incapacity of the vessel.

It is the opinion of several eminent ship-builders, captains of ships, engineers, surveyors and others, that steam-vessels, generally, are insufficiently found in anchors and cables. Several good judges of nautical matters have, in their communications (and many others personally), expressed to us their conviction, that a strongly-constructed, well-fastened steamer — from its peculiar build, and being unencumbered with lofty and heavy masts, spars, and rigging—could, with effective ground-tackling, ride out the most severe storms, even if her engines should be disabled.

It is to the credit of steam vessels, and a great proof of their superior security over sailing-vessels, *when in honest condition*, that no steamer was lost on our coasts during the hurricane of the 7th January last (almost unparalleled as it was in force and duration), excepting a small iron one, the *Tarbet*

Castle, on Loch Fyne, which, from her light draught of water, was unable to cope with it.

Explosions.

Earl Grey. — The explosion of the boiler of this vessel appears from the evidence to have been solely produced by the engine-man either having fastened down the lever of the safety-valve, or from the load upon upon it (if free) being too great for the strength of the boiler under the pressure of steam confined. The valve was weighted on the most vicious of all principles, that of a lever; it was altogether under the control of the man; and the boiler had no stays, which constitute nearly the whole strength of the rectangular form.

The same, or very nearly similar, construction of safety-valve is to be found in numbers of steam-vessels.

The evidence is deficient as to whether the boiler was amply supplied with water or not, or whether any of the well-known means were applied to it for ascertaining the level of the water, and the pressure of the steam. It was established that no steam had escaped for about 15 minutes, during which time the vessel remained alongside the pier; the explosion took place on the instant of setting on the engine to leave the pier.

The force of the imprisoned steam, in this case, rent the boiler round three of its sides, tore up the decks, destroyed ten persons, and injured many others.

Hercules.—This explosion seems to have been occasioned by a weight of coals having been suffered to lie upon the safety-valve. It is an instance of the danger arising from *accessible* and *exposed* valves, which are commonly in use in some of the ports of the north of England, and particularly in Scotland, both by river and sea-going steamers. The boiler was of the rectangular form.

James Gallocher.—This explosion is an instance of the same bad principle of construction in the safety-valve, and of the evil of intrusting the care of property, and lives, to an ignorant lad of 17 years of age, *who changed the original weights for heavier ones.* It is also an instance of an explosion occurring whilst steam was escaping through the safety-valve. The fire not having been slackened, steam continued to be created in greater quantity during the stoppage of the engine, than could pass off through the valve, till the pressure became too great for an old unworthy boiler. Its form was rectangular, and the rupture took place below the water-level.

In no one of the three foregoing cases can the valve in use be termed a safety-valve, which means a valve, self-acting at a determinate pressure, and of an area sufficient to discharge all the steam which the boiler can create at that pressure; such valves only are applied by really skilful engine-makers.

But few *inaccessible* safety-valves are to be found in use in the *river* steamers belonging to the ports of North Britain; their *area* is also almost universally too small to ease the boiler sufficiently when the engine is not at work. All the valves in the Clyde *river* steamers are *exposed*, and very few have steam-gauges.

An *exposed* valve, or a valve whose spindle is exposed on deck with moveable weights, or pressed upon with a steelyard lever, is liked by the reckless, ignorant engine-men, who have the habit of accumulating pressure in the boiler, some minutes before leaving their wharf or place of departure, in order to *race* other boats. The same vicious construction of valve is also to be met with in many of the *sea-going* steamers of North Britain. That few of the latter have exploded is, probably, owing to their not making frequent stoppages. Some critical escapes have, however, taken place even at sea, where the consequences of an explosion would have been most disastrous.

Several perilous instances of this nature have been related to us by men of veracity, and acquaintance with the subject. The following anecdote, communicated by an experienced commander of a steam-vessel, will show the variety of ways in which by accident, as well as from design, *exposed* safety-valves may be dangerously loaded, and at the same time exhibit an accumulation of negligence and ignorance in engine-men and firemen, with the absence of proper apparatus to denote the pressure of steam in the boiler.

A steamer, on her passage from Ireland to Scotland, was perceived by her commander during the night, and in a smooth sea, to be going with much greater than her ordinary velocity through the water. The engineer was not at his post; the captain inquired of the fireman how it was that the engines were going so fast: the man said, "he could not tell, for he had very little steam, and had been firing hard nevertheless." The captain began to look about him, and, approaching the chimney where the (*exposed*) safety-valves were fixed, he perceived a passenger fast asleep, with the greater part of his body resting on the flat, cheese-shaped, weights of the valve. This man had contrived, with some luggage, to make his bed there for warmth. On arousing and turning him off, the valve rose, and the steam escaped with a roar which denoted its having attained a very elevated pressure.

There was *no mercurial gauge* to indicate the pressure of steam to the fireman, who was accustomed to keep it as near as he could to the blowing-off point; and not hearing it escape, he "fired up," believing his steam to be low; and he was too ignorant to ascertain the fact, though the increased speed of the engines should have informed him that something unusual had occurred.

It is mentioned by several of our correspondents, that engine-men, firemen, and even masters, have frequently been caught *sitting* or *standing* on the safety-valves, or hanging weights and resting their bodies on the levers, in order to raise a high pressure of steam at the moment of starting.

(To be continued.)

NOTES AND NOTICES.

The *British Queen* has arrived in the Thames, and will leave London for New York on the 10th instant. We understand that the performances of her engines, with Mr. Samuel Hall's condensers, are of a very satisfactory character.

Hearne and Davies's Rotative Disc Engine.—A public company is about to be established in this neighbourhood for the manufacture of the "Patent Rotative Disc Engine," known to many of our readers as "the Stoke Prior Engine." Annexed to the prospectus is a copy of the report of Francis Whishaw, Esq., C.E., on the engine. Mr. Whishaw having been requested to examine and report on the principle of construction of the Rotative Disc Engine, and to institute a comparison between it and those of the reciprocating kind, devoted a week to the purpose, and examined six different engines, the whole of which were represented, by the parties at whose works they are in use, to have performed their duties most satisfactorily. One of these engines (Mr. Whishaw observes) has been working for fifteen months, and has only required during this period the expenditure of three shillings for repairs. Mr. Whishaw continues—"The advantages to be derived from a rotative engine of simple construction, yet producing a mechanical effect equal to one on the reciprocating principle, at much less original cost, and with less expenditure of fuel, must be obvious to every one. Such a machine has long been a desideratum amongst engineers. The attempts which have hitherto been made to accomplish this desirable object, so far as my knowledge extends, have failed, either from the motion of the various parts of the machine being such as to produce so great an amount of friction, and, consequently, of rapid destruction; or from the engines requiring a greater supply of steam to effect a given amount of work. In my examination, therefore, of this invention, I have particularly directed my attention to these two important points. As regards the first, I find the moving parts of this engine are so few in number, and their motion so uniform and regular, that the amount of friction must be very materially reduced; the wear, therefore, of these moving parts, and their liability to derangement, will be reduced in a proportionate degree. This opinion is fully borne out by the examination I have made of several engines, which have been in operation for a considerable time; some of these were taken to pieces in my presence, for the purpose of ascertaining the wear of the moving parts, the amount of which appeared so small as to be inappreciable. With respect to the second, viz., the quantity of steam required to perform a certain amount of work—I have made several trials with an engine of this construction at the works of the British Alkali Company, near Bromsgrove, which is applied to a great variety of work, but as a considerable portion of the duty performed consists of pumping, I was thus enabled to make such a comparison between the different portions of the work, as to obtain an accurate indication of the whole duty performed. The result of these trials is, that the work done by this twenty-four inch Disc Engine, working with steam at 29lbs. pressure, is equal to twenty horses' power, after making ample allowance for friction; and the consumption of fuel (common Staffordshire coal) is equal to *two hundred weight* per hour, or rather more than *eleven pounds* per horse per hour. This engine is worked by high-pressure steam, which, after performing its duty, passes into the atmosphere; and, during the experimental trials, I found, by the mercurial steam gauge, that the average pressure was equal to 29lbs. on the inch; but in order to work this engine to the greatest advantage, the pressure should be considerably increased. I am informed, that this engine was fixed upwards of twelve months ago, at which time the patentees had not acquired the experience in its construction which they now possess. Taking all these circumstances into consideration, viz., the want of experience, the disadvantageous pressure at which the engine is working, the inferior quality of coal used, and the amount required per horse power, and, moreover, that this amount does not exceed the quantity consumed for a high-pressure reciprocating engine of equal power, I am of opinion, that Rotative Disc Engines, constructed with all the advantages necessarily to be obtained by experience, will be found to be decidedly economical as regards the consumption of fuel. This engine, which I find to be equal to twenty horse power, with steam at 29 lbs. would, with steam at 43½ lbs, be equal to thirty horse work. It occupies a space equal to four feet square by seven feet high, and its whole weight, including the frame, is 41 cwt. 3 qrs. 16 lbs., but as the frame of this engine is too light, an additional weight will be necessary for giving steadiness to the machine, which would probably increase the weight to 2½ tons; whilst, I am informed, that the weight of a high-pressure reciprocating engine of equal power would not be less than twenty tons. The foundation of this engine consists of brick-work occupying four feet square by five feet deep.—*Midland Counties Herald.*

Preventing loss of life by the burning of Ships.—An invention has been shown to us by Mr. W. H. Ordnixon, of the Royal Navy, applicable to shipping of all descriptions, by which an additional security may be given to human life in the various contingencies incident to crews and passengers at sea. The plan has been submitted to several distinguished officers who, from its simplicity and efficiency, have expressed their confidence that the object in view has been effectually attained. We are not yet at liberty to give the details of this plan, as it forms the object of a patent, but shall recur to it in due season. The frequent and deplorable losses of life on our coasts render some resource, upon a more extended scale than the means usually employed, a *desideratum* in our marine

The thirtieth Volume of the *Mechanics' Magazine* is published, illustrated with a splendid Engraving of a LOCOMOTIVE ENGINE, on the scale of 1½ in. to a foot—exhibiting the whole of the machinery of the engine, and explaining its action.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 6, Peterborough-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

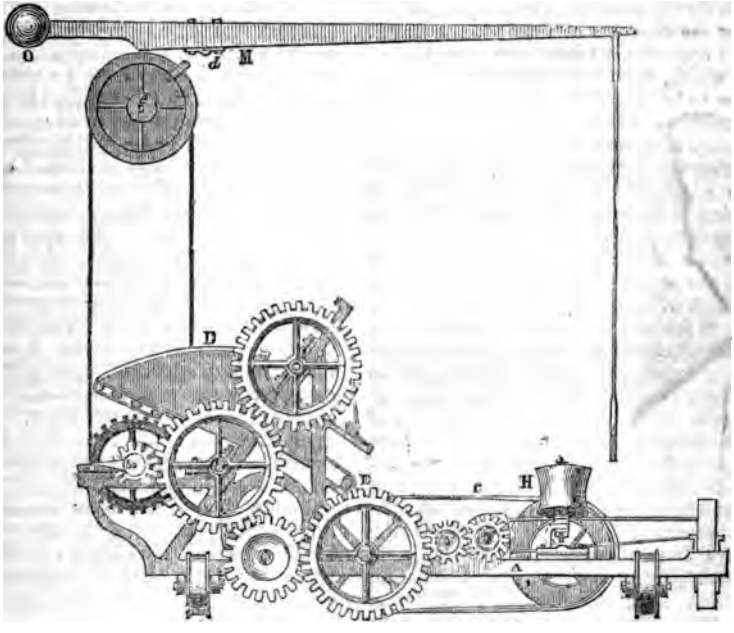
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

[No. 831.] SATURDAY, JULY 13, 1839. [Price 6d.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

THE MARQUIS OF TWEEDDALE'S BRICK AND TILE MAKING MACHINERY.

Fig. 1.



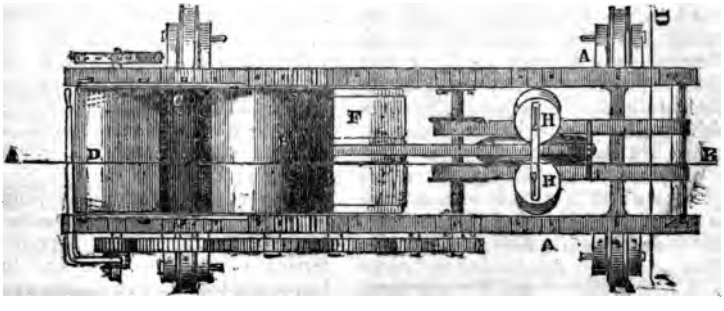


Fig. 2.

THE MARQUIS OF TWEEDDALE'S BRICK AND TILE MAKING MACHINE.

The proper drainage of land being essential to its fertility—economy in performing the requisite acts to effect this end, is of the utmost importance to the agriculturist. The means most extensively in use, especially in the north of the kingdom, to effect the removal of the surplus water of a soil, is the formation of drains or conduits under the surface of the earth, by means of tiles of a somewhat semi-cylindrical shape. It was for the purpose of making these tiles that the Marquis of Tweeddale brought into operation his inventive talents, and, of which, the very ingenious machinery now to be described was the result. His Lordship obtained Letters Patent for the United Kingdom, in 1836. The invention having this prime end in view, the apparatus which we have now the pleasure of laying before our readers, in its minor arrangements, is peculiarly adapted to the purpose of tile making—but to apply it to the equally useful and extensive branch of our industry,—brick making—but few alterations are required, and these are clearly pointed out. The same machine may be constructed so as to be set to make all varieties of tiles and bricks, and this, as the most extensive application of the invention, is the one which we have described. Some remarks upon the machine and accounts of its performances and capabilities we have already published in our report of Mr. Cottam's lecture at the Royal Institution, upon the subject (p. 62 of our present volume), and also in an extract from the *Farmer's Magazine* (p. 192); these render any further comments unnecessary, and we now proceed fully to describe his Lordship's invention:—

The clay of which the tiles or bricks are to be made is prepared by passing it between two large cylinders, placed horizontally at a distance of about half an inch from each other, by which means any small stones or other hard substances which may happen to be embedded in the clay, are crushed and broken. The clayey mass is next milled in the usual way, after which it is ready to be formed into tiles or bricks.

Machine for making Tiles for Draining.—This machine is represented in figures *1, 2, 3, and 4 (Figs. 1 and 2 on our front page,) of which fig. 1, is* an elevation; fig. 2, a plan; fig. 3, a section through the line A B, of fig. 2; and fig. 4, a section through the line C D of fig. 2. A, is a frame of cast iron mounted on wheels; B C, two cast iron cylinders of eighteen inches diameter, and of equal lengths, for compressing the clay to the proper breadth and thickness for draining tiles. These cylinders are made to revolve in contrary directions, by means of the toothed wheels *a a*, fig. 1, which are keyed to the outer ends of the axes of the cylinders, and are driven at the same speed, having each forty-eight teeth. The lowest of these cylinders, C, is driven by the pinion, *b*, which is provided with a bush, that revolves loosely on its axis, and is engaged and disengaged by means of a clutch, wrought by a lever, so that the machine can be stopped in an instant, and *vice versa*. The periphery of this pinion, *b*, is set off to eighteen teeth, but has only fifteen cast on it—a space equal to that of three teeth being left blank so as to produce a temporary stop or halt of the machine while the tile is being cut or cast off by a wire or cutter, as will be afterwards described. For every revolution made by this pinion, one drain tile is formed, equal in length to the circumference of the pinion, deducting the space of the three teeth left blank. When greater lengths of the tiles are required, the pinion must have a proportional increase of teeth, and when the tile is required to be of a shorter length, the number of teeth must, on the other hand, be diminished. The lower cylinder, C, turns in stationary bushes, and the upper cylinder, B, in moveable bushes; that is, the bushes are cast with slits in them, in order to their being set nearer to, or further from, each other, to suit the various thicknesses of the tiles which are to be made; D, is the hopper or feeding apparatus; to the lower edges of the sides of this hopper, four or more rollers, placed in an inclined position and turning in bushes, are screwed; and around these rollers there travels an endless web consisting of moleskin, leather, or any other like flexible material, which leads the clay forward to the cylinders B C, the lowermost of which, as soon as it has hold of the clay, continues to keep it advancing. It will be observed, by referring to the drawings, that the clay leaves the feeding web a little way below the line of contact of the two cylinders.

Now the object of this is to afford the lower cylinder a greater degree of surface contact with the clay, than it would have if the latter entered immediately at the line of contact.

Clay, from its nature, (with few exceptions) has a tendency to adhere to the cylinders, therefore, to obviate, or counteract this, each of them is covered with an endless web of any of the textile materials directed to be used for the feeding apparatus, and these webs are

Fig. 7.

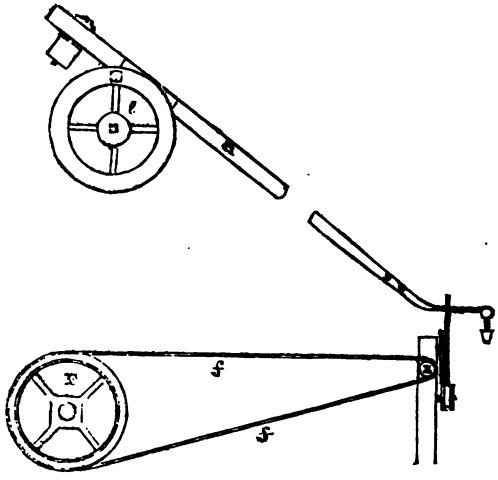
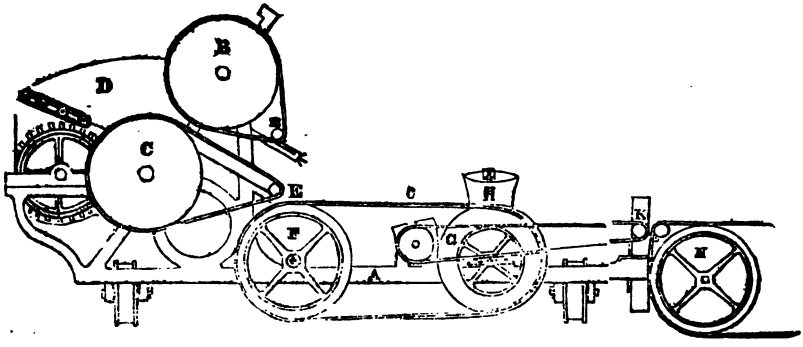


Fig. 3.



distended over rollers E E, figs. 1 and 3, which are adjustable by screws for the purpose of keeping the distension perfect. The cylinders B C, may have on their ends a recess, turned out to receive a belt or rope which may be attached either to or below the edges of their respective endless webs, the use of which belts or ropes is to prevent the webs from travelling to either side of the machine, as sometimes happens when such additions are not used.

To give the clay the requisite breadth as it passes between the cylinders, B C, the hopper at that part next the lower cylinder, C, is narrowed by means of pieces of wood covered with brass, suitably fixed, but free of the web, as shown by dotted lines, fig. 2. The edges of the clay after coming through between the cylinders, require, generally, a little dressing, for which purpose there are provided two vertical cutting wires, one to each edge.

From the endless web of the lower cylinder, C, the clay is received upon another endless web, C, that passes round a third cylinder, F, (figs. 2, 3), which is turned in the middle of a form having a rough resemblance to a draining tile with its convex side uppermost, to which form the endless web readily accommodates itself. G, is a pulley, or cylinder, over which the endless web, *c*, is stretched or distended, from which web the tile is conveyed to two rollers, H H, which are made exactly of the desired shape of the tile, and are moved round by its coming in contact with the endless webs: distended webs may also be attached to these rollers to prevent any adhesion of the tile, but in practice they have not been found to require such aids. These rollers move around pivots which are adjustable, as to height, by screws and nuts, and move laterally at top and bottom in slits, in order that they may be fixed at any required distance from each other, or raised or depressed according as the thickness and size of the tile may require.

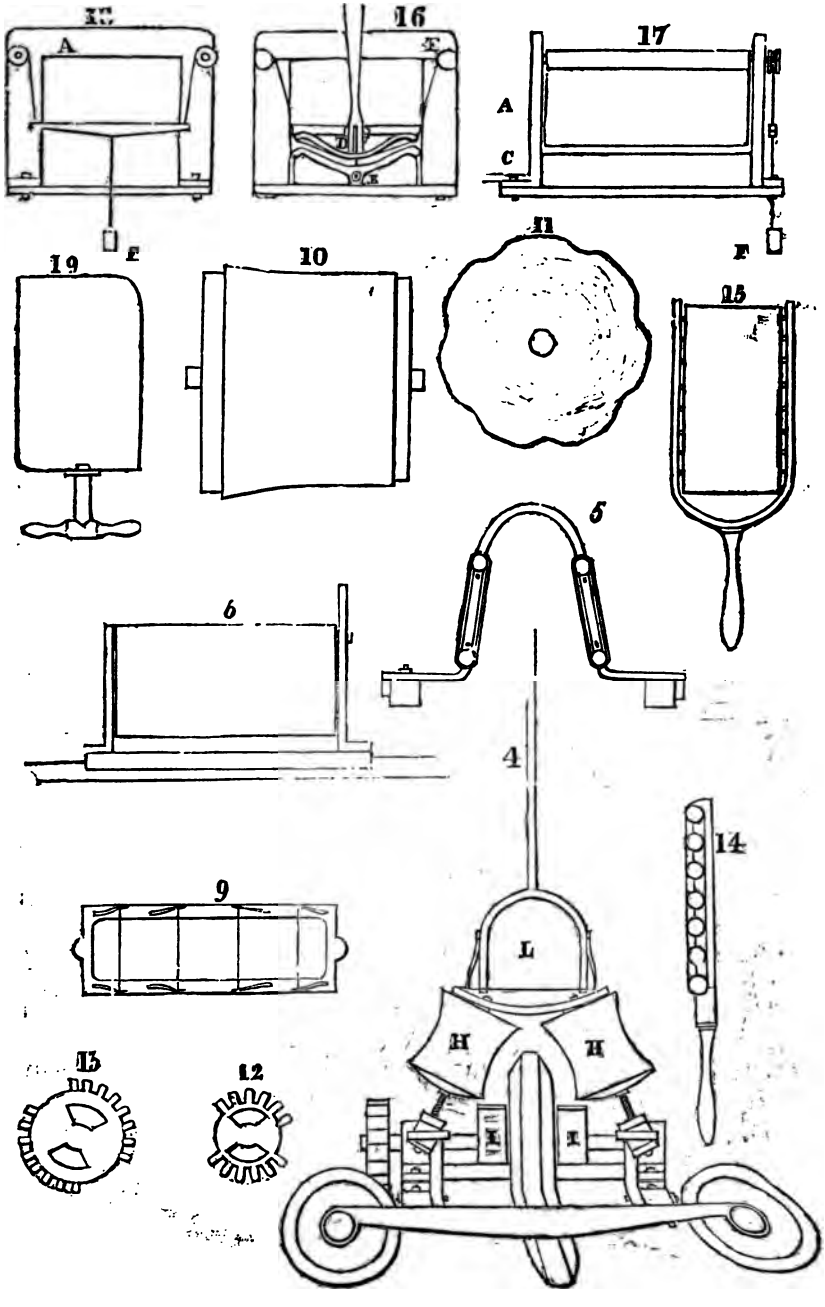
From between the rollers, H H, the tile is next received upon two narrow endless leather belts, which move round the rollers I I and K, (figs. 3, 4) and which belts advance the tile forward to the cutting or dividing wire, L, which will be afterwards described. The rollers must be adjustable as to height by making suitable provision for their bushes sliding up and down in slits, to admit different sizes of tiles, and the bushes placed on the roller, K, must be adjustable in the direction of the length of the machine, for the purpose of tightening the belts by means of keys. The slits may be segments of circles, taking the axis of the cylinder F, for their centre, in order that the pinions may be shifted up or down without varying their degree of contact with each other.

The tile is cut to its length by the cutting or dividing wire, L, figs. 1, 4, which consists of a frame, formed on the lower end of a connecting rod attached to a lever, M, fig. 1. The wire is stretched across this frame, and is fixed at each end to cords, carried through the lower end of the frame, and fixed to springs, the object of the cords and springs being to prevent the wire breaking from any *hard substances which may* remain in *the clay, or otherwise.* The lower end *of the connecting rod moves* in a slit in order that it may work the cutting wire perpendicularly, and is attached to the lever, M, which moves on a fulcrum at *d*, attached to the roof of the manufactory, or to any other suitable support. The lever, M, receives motion from a wheel, *e*, fixed on the main shaft which gives motion to the machine or apparatus, and this wheel is provided with a cog, as shown in fig. 1, the use of which is to depress, at each revolution, the opposite end of the lever, and along with it the cutting wire, which then cuts the tile to its proper length. To raise the cutting wire instantly after the tile is cut, the end of the lever, M, is loaded with a weight, O. On the main shaft is also fixed a chain wheel, adapted to receive an endless chain, which is again connected with the wheel upon the opposite end of the axle of the pinion, *b*, to give motion to the machine.

The tile being now complete, is conveyed by another endless web carried over a cylinder N (figure 3) and distended over a roller placed at some little distance, to the alleys where it is to be deposited for drying.

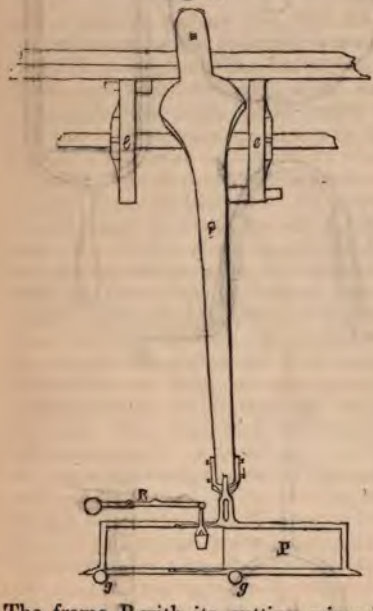
When the tile has to be conveyed to a great distance on the endless web to the place of drying, and is in consequence liable to get out of shape, a travelling frame is used for the purpose of keeping or restoring it to the required shape. This frame (figures 5, 6) is placed across the endless web, and consists of two horizontal sides, on the ends of which are affixed uprights inclining inwards. Between these uprights are four rollers moving in bushes, and laid lengthways, two at top and two at bottom, so that endless webs may be carried over them. The tile is lifted from the endless web of the cylinder N, and raised upwards upon a block of wood of the shape of the tile, and generally known by the name of horse, and on its reaching the top of the frame it comes gently in contact with the web, and is thus corrected in its shape. This frame is made to travel along and be stopped at any part of the distance between the one end of the alley and the other, wherever there may be occasion to use it. That the apparatus or machine may be stationed immediately opposite the alley in the drying shed in which the tiles are to be deposited, it moves on a railroad in length equal to the breadth of the shed, and it is for this purpose that the frame

is provided as before mentioned, with wheels. The main shaft which drives the machine is also in length equal to the breadth of the drying shed, and opposite to each alley a chain wheel and two cog wheels with levers are fixed on the main shaft.



For making the tiles called soles, the clay is introduced into the apparatus or machine by the feeding apparatus in the same manner as for the draining tiles; it then passes between the cylinders B C; next along the endless webs until it arrives at the cylinder F, which to suit this purpose requires to be modified in its construction as follows. The cylinder G and its endless web *c* is removed, and another endless web of the full breadth is passed round the cylinder F, and also over the roller K, which must be raised to the same level as the top of the cylinder F—all as shown in figure 7. The clay proceeds along this endless web towards the wire-cutter in the frame P, figure 8, and is supported by and moves on the two friction rollers *g g*.

Fig. 8.



The frame P with its cutting wires is fixed by a joint to the lever Q, which again is fixed to the roof of the manufactory, or other suitable support, by a bolt or pivot on which it moves. This lever, and along with it the cutting frame, is made to move either to the right or left by the wheels *e e*, each of which is fitted on its innermost side with a cog for the purpose; these cogs acting alternately on the lever as the wheels *revolve, being restricted from going too far either way by a suitable fixture on* the frame not shown. There is also another fixed frame (figure 9) of about eighteen inches in length, in which are fixed two or more vertical cutting wires for the purpose of dividing the clay into the proper breadths for soles or flats, and it must have either slits or holes in it, or both, to permit of the shifting of the cutting wires to suit different breadths of soles, and it may be fixed at each end to the two moveable bushes already mentioned, or to the frame. It is immaterial whether this frame be fixed before or behind the sliding cutting frame in the machine. The soles or flats being now completed, may be conveyed to the drying sheds as in the case of the draining tiles.

Machine to make house tiles.—The modification requisite for this purpose in the machine just described, are shewn in figures 17, 18, and 19—A A is the frame, the lower part of the machine B seen in figure 19, and consists of a moveable mould in the form of the under surface of a house tile which moves out from and into the frame on a circular iron rod *c*, through bushes formed on the under sides of the mould. The higher part of the machine consists also of a moveable mould D, in the form of the upper surface of a house tile. This mould moves perpendicularly by means of slides on its four corners, which work in grooves in the frame. To one side of the lower mould B, a piece of cloth is fixed so as to admit of its being spread over its upper surface to prevent the clay adhering to the mould. A cloth *a a* also is interposed between the under surface of the higher mould and the clay, which cloth is wound up and kept tight when the higher mould rises by the rollers on each side E E and the weight F. When a tile is to be made, the under mould is drawn out by its handle, and a sufficient quantity of clay for one tile is put on its surface, and it is then pushed into its place in the frame. The higher mould, which is wrought by a lever or crank, as may be most convenient, is then alternately brought down with sufficient force to form the tile, and raised again. The lower mould is then drawn out by its handle, and by a half revolution on the iron rod, it throws off the tile which is received on an inverted mould, and conveyed by it to the drying shelves. The operation is repeated in making every tile.

Machine for making flat roofing tiles.—When they are required to be made of an equal thickness throughout, the upper cylinder B before described will answer the purpose; but if it is preferred to make them thin at their upper or nail ends, the upper cylinder B is to be converted into the form represented in figure 10, which is done by applying an iron hoop to one end of it, which will give the tile the form of a curvature wanted. As the tile requires to have a hole formed in it for the reception of the roofing nail, this is effected by means of a punch which is applied thus:—At the time the stoppage takes place in the machine as is before described, and the tile is cut by the lever Q, figure 8 moving to either side, the lever at the same instant depresses the small lever R to which the punch is attached, and the punch in consequence forms the hole required. This punch is made in the principle of that used for piercing leather, that is, hollow inside, whereby it discharges the pieces of clay cut by it at top: the diameter may be three-eighths of an inch. In making flat roofing tiles adapted to be laid upon lath instead of sacking, a flat knob or prominence must be formed on its upper end, similar to that on a common house tile. This is done by using a cylinder of the form shewn in figure 11, that is, having hollows or indentations of the form adapted to the tile, cut out around one end of it, into which hollows or indentations, the clay is pressed in its progress through the cylinders. As flat roofing tiles are shorter than those used for draining, a driving pinion is used of larger diameter than that used for draining tiles, such as is shewn in figure 12, set off for eighteen teeth, the space for six of which is left blank, one half on each of the two opposite sides. The reason for having two blanks and two toothed parts on this wheel is, that where a pinion having only one blank in it used, it would necessarily be so small that it would not work efficiently. The bushes in which this axis revolves being cast with slits in them, must be shifted to enable the pinion to operate on the wheels on the end of the cylinder C. It will be observed by this description, and from the figures on the ends of the cylinders, figures 10, 11, that the tiles are passed *through the machine sideways*, instead of lengthways, as in the case with the draining tiles and soles.

When any of the varieties of flat roofing tiles have been submitted to the operations detailed in the foregoing description, they are considered as finished, and as ready to be conveyed to the drying sheds. For removing flat tiles of any description to the drying shelves, in place of the common peal, an improved instrument of the form represented in figures 13, 14, is used. It consists of a light iron frame, provided with a number of rollers, over which is stretched an endless web. Upon the tile being put into the shelf, the frame is withdrawn, in doing which the web revolves in consequence of the adherence of the tile which is thus cleared of the frame.

Machine for making bricks.—The principal alteration in the machine, required to make it applicable to this purpose, is to raise the upper cylinder B by means of the slits in its bushes to the requisite distance apart from the under cylinder C, so as to admit clay of the thickness of the brick. By such change the toothed wheels used on the ends of the cylinders B would be put entirely out of work, but they are not removed, but other toothed wheels are placed on the opposite ends of their axes of an increased diameter corresponding to the thickness of the brick proposed to be made. The hopper, or feeding apparatus, must be so narrowed at the end nearest the cylinder (as in the case of the various tiles and soles already described) as to give the clay the exact breadth required, whether for two or three bricks, as the case may be. The bricks next pass forward to the dividing frame, or cutting wires, the wires in the frame being previously shifted to cut the brick to the proper breadth. In cutting the bricks to their length, another driving pinion, such as is represented in figure 15, must be used instead of that last described for draining tiles and soles, and set off for twenty-two teeth, of which three are to be left in blank on each of the opposite sides, that is the said driving pinion must have sixteen acting teeth, and two blank spaces at equal intervals. The bricks being now complete, may be conveyed to the field in the same way as described for drain tiles. In the formation of bricks

having hollows or cavities of any kind or form on one or both of their broad surfaces, projecting pieces (fixed with countersunk screws) corresponding to the form required, are placed on the peripheries of both cylinders B C, which pieces produce the required hollows or forms on the bricks; care being taken to use cylinders of a size calculated to be divided into the number of lengths of bricks wanted to be made in any one revolution of the cylinders, and that both upper and lower cylinders present their pieces in unison with each other, so that the flat surface left on the edges of the bricks may be alike perfect on both sides. The best form of cavities on the flat surface of bricks are longitudinal lines, the whole length of the brick, and to form any particular number of these longitudinal lines, and of any particular size all that is necessary is to attach to the surface of the endless webs next the cylinders cords in number and thickness corresponding with the number and size of the intended lines. On the clay entering the cylinders the endless webs yield to the pressure while the cords orm the lines required.

The apparatus we have described is very ingeniously contrived, so that with very little alterations the same machine may be adapted to the making of the various descriptions of tiles and of bricks, but where it is only required for the purpose of brick making, its construction may be much simplified. The Marquis points out the following variations from the previously described arrangements.

The upper cylinder is placed directly above the lower and the feeding apparatus in a horizontal direction, a little below the top of the under cylinder. Motion is given to the endless web of the feeding apparatus by passing a belt over a sheave on the axis of the under cylinder, and over a sheave on the axis of the outer roller of the endless web. To compress the sides of the clay before it enters the cylinders, two small upright cylinders are placed close to and immediately before the other cylinders, the lower ends of which run close to the endless web, and are put in motion by the advancing of the clay. These upright cylinders run in moveable bushes adjustable to the breadth of clay required. To keep the clay at the breadth given it by the upright cylinders, as well as to keep them clean, two plates of iron or other metal are suitably fixed between the upper and under cylinder, but free of the webs, and their ends are so formed as to act on the faces of the upright cylinders as cleaners. With the machine thus constructed, the clay is cut into bricks of the required length and breadth immediately on its leaving the endless web of the lower cylinder.

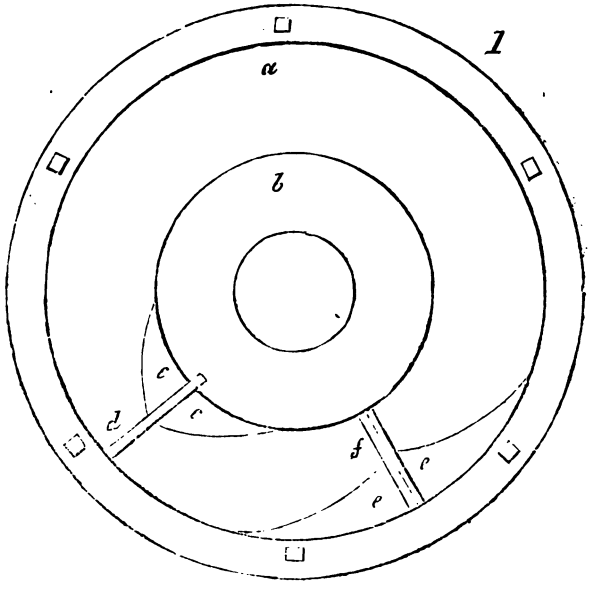
TRANTER'S ROTARY ENGINE.

Sir,—The annexed drawing is a representation of a rotary steam-engine which I invented a short time since, and as I have reason to believe the invention is original (at least original with me), I beg leave to submit it for the perusal of the readers of your valuable Magazine, if you deem it worthy of their consideration.

As I have not made a model of this engine, or seen any engine at work on this principle, I cannot be expected to attest its efficiency; but if I may be allowed to give my own opinion, I may say that it will surpass in utility any rotary engine which I have yet seen.

a represents a cylinder of the general form; *b* a barrel or roller, solid or hollow as may be required, with two pinions working in two stuffing boxes; *c c* two inclined planes attached firmly to *b*, and serving to support and keep *d* in a proper position. *d* is a plate of iron the length of the roller or barrel, and extending from the inner edge of the cylinder to a little distance into the barrel, and working inwardly from the edge of the cylinder to the extremities of *c c*. *e e* are two inclined planes, at an angle of about 25 degrees, and extending a little more than half the distance between the inner edge of the cylinder and the outward surface of the barrel *b*. *f* is a flat plate extending from the surface of the barrel *b* to the outward edge of the cylinder *a*, between the inclined planes *e e*, and working through a nick in the cylinder two-thirds the length of the cylinder *a*. Each end of the flat plate *f* will also work in a nick or groove cut half way across the two end plates of the cylinder *a*. To the outside of the cylinder is affixed an oblong square box *g*, covering the slit in the cylinder *a*. The flat plate

1



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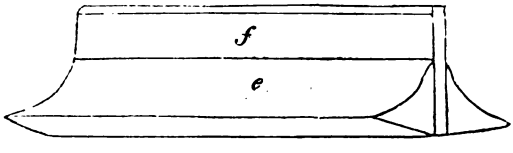

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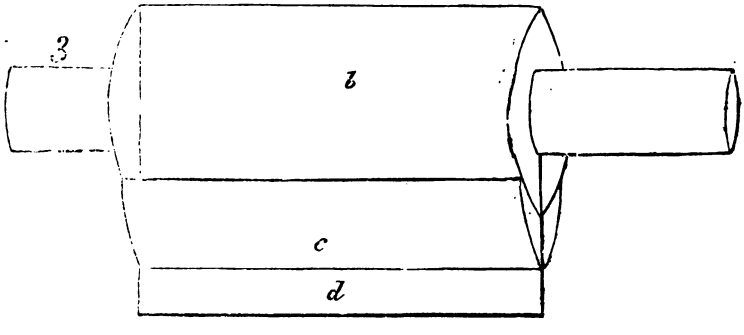
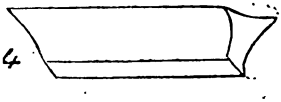




f, when pressed downwards by the inclined planes *c c*, will enter this box *g*. At the end of this box are placed the valves for making the engine work either way. The steam is made to enter either side of the flat plate *f*, and escape at the other end of the box *g*, and escape on either side of the flat plate *f*, according to the way the engine is wanted to work. The flat plate *d* is made to press to the inward edge of the cylinder *a*, by means of a spring affixed to the bottom of the groove in the barrel *b*, into which the flat plate *d* works. When ascending the inclined plane *e*, there is also a spring in the square box *g*, which presses the plate *f* against the barrel *b*. Fig. 1 is an end view of the cylinder without the end plate. Fig. 2 is a sectional view of the inclined planes *e e*, and the slide plate *f*. Fig. 3 is a sectional view of the barrel *b*, inclined planes *c c*, and the slide plate *d*. Fig. 4 is a sectional view of the square box *g*. The slide plate *d* is thicker than the slide plate *f*. An engine might be constructed with only one slide plate, and two inclined planes.

This engine may be worked as a condensing engine the same as any other, and a more perfect vacuum may be obtained, because the stroke is longer, and consequently more time is allowed to obtain a vacuum.

It will, perhaps, be urged as an objection, that the slide plates will soon get out of repair through ascending the inclined planes. I am far from entertaining that idea, for the steam pressing at the back of the slide plates will be more than sufficient to overcome the friction of the slide plates upon the inclined planes.

WILLIAM TRANTER.

35, Warwick-street, April 9, 1838.

EXPERIMENTS WITH THE NEW LIVERPOOL FIRE-ENGINE, BUILT BY MR. MERRYWEATHER.

Sir,—On Saturday, June 29th, much interest was excited in Hyde Park by an exhibition of the relative powers of the London Fire-engines, and one which Mr. Merryweather has just completed for the Liverpool Fire-police. The trial, by permission of his Royal Highness the *Ranger, was appointed to take* place on the south bank of the Serpentine river. Soon after nine o'clock, two fine engines, one from the Watling-street, the other from the Jeffery's-square stations, arrived on the spot, accompanied by twenty firemen under the direction of Mr. Braidwood, the superintendent of the London Fire Establishment. These were quickly followed by the great Liverpool engine, drawn by four horses, and attended by Mr. Merryweather, the manufacturer, Mr. Whitty, the superintendant of the Liverpool Fire-police, and a party of Mr. Merryweather's workmen. A deputation from the Committee of Managers of the London Fire-establishment and several scientific gentlemen were present, to witness the trial. Sixty men of the Coldstream guards were in attendance to assist in working the engines.

The leather hose of the two brigade engines being united into one by means of a breeching, a branch was attached furnished with a nose-pipe one inch in diameter; the Liverpool engine was similarly equipped, and on the signal being given they all got into full work. Nose-pipes one inch and an eight were next tried, and afterwards one inch and a sixteenth; two powerful jets of water were thrown to a nearly perpendicular height of eighty feet, and a much greater elevation would have been attained but for the strong wind that was blowing at the time. The branches being held at an angle of 45°, the stream of water was thrown a distance of one hundred and thirty feet.

In the opinion of those present, it was considered that the powers of the Liverpool engine were nearly if not fully equal to the combined forces of the two London engines, each having two working barrels seven inches in diameter, with an eight-inch stroke. The Liverpool engine was evidently labouring under some disadvantage from the contracted water-way of its hose, which was much too small for an engine of such power.

The cistern of the Liverpool engine from end to end measures eleven feet; the breadth, including the pockets, is 3 feet 8 inches. The handles are nineteen feet six inches long: the working lever is 2 feet 7 inches radius. The barrels are 9 inches in diameter, with an 8-inch stroke. The total weight is 35 cwt.

In consequence of the vast piles of warehouses in the town of Liverpool, liable to be endangered by fire, and the extremely destructive progress upon several recent occasions, of conflagrations—the Fire-police of Liverpool, as of Manchester, are in the habit of employing fire-engines of much greater powers than those we are accustomed to see in operation.

Engines of the foregoing description are valuable acquisitions in the neighbourhood of large warehouses and manufactories in the vicinity of docks or rivers, or wherever an adequate supply of water can be ensured; for the general purposes of this metropolis, however, they are much too heavy and unwieldy for our rate of travelling, and would very frequently be rendered useless from the impossibility in many situations of procuring a sufficient quantity of water to supply them. Upon the present occasion water was abundant, and the performances of this magnificent engine gave great satisfaction to all present, and did infinite credit to its builder. The two brigade engines were subsequently tried against each other, but they were so nearly matched that it was difficult to discover any difference in their effects; with nose-pipes seven-eighths of an inch in diameter, their performances were admirable.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

London, July 4th, 1839.

BUNNETT AND CORPE'S PATENT CONCENTRIC STEAM-ENGINE.

Sir,—Since writing the description of Messrs. Bunnet and Corpe's Patent Concentric Steam-engine, which appeared in your last number, I find that Mr. Bunnett has completed another set of experiments much more extensive than those already published, for the purpose of ascertaining, with the greatest possible accuracy, the relative advantage of their peculiar mode of construction, as compared with the present engines, in which alternating rectilinear motion is converted into circular motion by the agency of the crank. As a mere verbal description is scarcely adequate to convey a correct idea of the nature of these experiments, I enclose two illustrative diagrams, by the aid of which I trust that the experimental process will be made perfectly intelligible. In this instance we have the sum of all the forces required to effect a complete revolution of the crank, taken at intervals of 5° throughout.

Fig. 1 shows the position of the connecting-rod as applied direct from the circular piston-rod in Bunnett & Corpe's

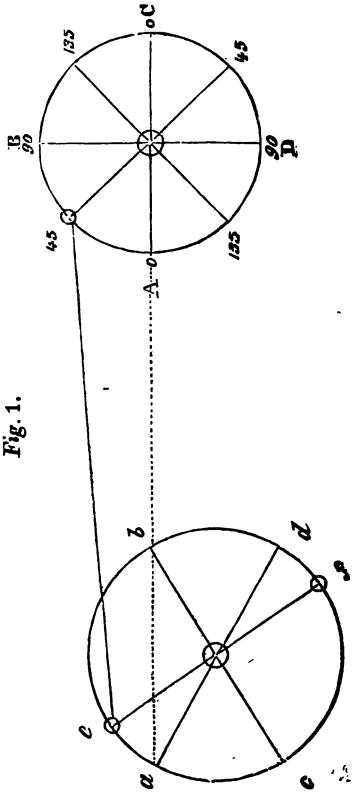


Fig. 1.

patent concentric engine. *a b* are points between which the end of the connecting-rod reciprocates. *c d* are points between which the piston *f* reciprocates. *e* is the position of the end of the connecting-rod, when the crank is at an angle of 45°. The crank had a nine-inch throw.

Fig. 2 exhibits the position of the connecting-rod of a common reciprocating steam-engine with a horizontal cylinder.

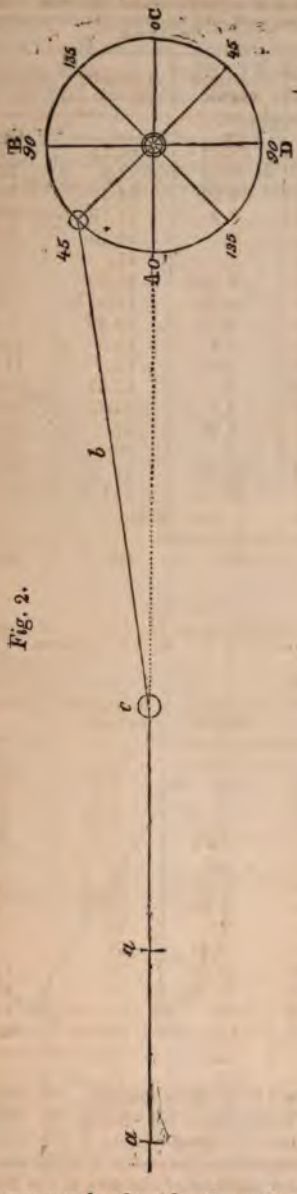


Fig. 2.

a a are a couple of guides through which *the piston works freely; b* represents the *piston-rod, and c the end of the* connecting-rod, the crank being represented at an angle of 45° as before.

The details of the experiments are set forth in the following table:—(See opposite page.)

From this table it appears that the gross amount of weights necessary to make one whole revolution of the crank was— lbs.

With the concentric engine .. 965.75
With the horizontal cylinder.. 2046.37
Leaving the difference between them..... 1080.62

The result of this investigation goes to establish an advantage of more than one half in favour of the concentric engine, upon mechanical principles alone, independent of other sources of superiority in the working of the valves and the efficient application of steam power.

Many persons at first sight are apt to confound the *concentric* with the fan-like vibratory engines, modifications of which have been patented by Galloway and some others. There are, however, essential points of difference, and it is these very differences that constitute the value and superiority of the concentric form. A very beautiful engine on this principle, about one horse power, may now be seen at the patentees office in Lombard-street, to which I beg to refer all those who feel an interest in this subject.

I remain, Sir,
Yours respectfully,
WM. BADDELEY.

London, June 29, 1839.

PERFORMANCE OF MR. HALL'S CONDENSERS ON BOARD THE "BRITISH QUEEN."

Sir,—As it has been erroneously supposed by many that the excellent passages of the *British Queen* from Greenock to Liverpool, and from the latter place to London, have been made by the working of the engines without my condensers, I beg to state, that such suppositions are entirely void of foundation. I have been on board during the whole of the passages, and positively assert, that not a single stroke of the engines has been made except by the working of my condensers; and I contend, without fear of contradiction, that they have produced a great comparative increase of power in the engines beyond what they would have

No. 1.—From A to B.

In this Experiment, a 10lbs. Weight was suspended at the end of the throw of the Crank, commencing at 5 degrees above its dead centre at A, and continued to B.

Degrees.	Concentric Engine.	Horizontal Cylinder.	Difference.
	lbs.	lbs.	lbs.
5	69.	146.	77.
10	43.	77.	34.
15	33.25	50.	17.75
20	25.25	39.5	14.25
25	21.5	30.25	8.75
30	18.5	25.75	7.25
35	15.25	21.	5.75
40	14.5	18.	3.5
45	12.5	15.75	3.25
50	11.25	13.5	2.25
55	9.5	12.	2.5
60	8.25	10.	1.75
65	6.5	8.75	2.25
70	4.75	7.5	2.75
75	3.	5.87	2.87
80	1.25	4.25	3.
85	.75	3.5	2.75
90	.25	1.87	1.62
	298.25	490.5	192.25

No. 2.—From B to C.

In this Experiment, the Weight was passed over a Pulley, and attached to the throw of the Crank; the Pulley was shifted continually, so as to render the acting force uniform in the various positions of the Crank.

Degrees.	Concentric Engine.	Horizontal Cylinder.	Difference.
	lbs.	lbs.	lbs.
95	10.62	15.25	4.63
100	9.62	13.5	3.87
105	9.12	14.5	5.37
110	8.5	14.75	6.25
115	8.	14.75	6.75
120	7.	15.	8.
125	6.25	15.12	8.87
130	5.25	14.5	9.25
135	4.75	13.25	8.5
140	3.5	13.5	10.
145	2.87	14.	11.12
150	3.	17.87	14.87
155	4.5	24.75	20.25
160	6.25	32.	25.75
165	8.	38.	30.
170	13.25	58.	44.75
175	30.	114.	84.
180	dead centre.		
	140.5	442.75	302.25

No. 3.—From C to D.

In this Experiment, the Weight was also passed over a Pulley, which was shifted frequently, as in No. 2 Experiment.

Degrees.	Concentric Engine.	Horizontal Cylinder.	Difference.
	lbs.	lbs.	lbs.
5	70.	160.	90.
10	32.	76.5	44.5
15	21.25	39.	18.75
20	18.	29.	11.
25	14.5	24.	9.5
30	13.	20.75	7.75
35	11.5	18.75	7.25
40	11.5	17.75	6.25
45	11.	16.25	5.25
50	12.5	16.	3.5
55	13.	14.75	1.75
60	13.25	14.75	1.5
65	13.	15.75	2.75
70	13.	14.5	1.5
75	12.5	14.5	2.
80	13.	14.	1.
85	12.75	13.75	1.
90	12.25	13.	.75
	318.	533.	215.

No. 4.—From D to A.

In this Experiment, the Weight was suspended from the throw, as in No. 1 Experiment.

Degrees.	Concentric. Engine.	Horizontal Cylinder.	Difference.
	lbs.	lbs.	lbs.
95	2.	3.5	1.5
100	3.	4.5	1.5
105	4.	6.25	2.25
110	4.75	7.5	2.75
115	5.5	9.12	3.62
120	6.37	11.	4.62
125	6.62	12.75	6.12
130	7.	15.	8.
135	7.25	18.	10.75
140	8.	20.	12.
145	8.75	24.	15.25
150	10.	28.75	18.75
155	11.	35.25	24.25
160	14.	49.5	35.5
165	19.	70.	51.
170	28.75	105.	76.25
175	63.	160.	97.
180	dead centre.		
	209.	580.12	371.12

been with injection condensers, and that this will be proved whenever they are tried (for doing which an arrangement is made) with the latter mode of condensation. As a proof of this, I beg to state, that the steam ship *India*, with engines of 320 horse power was tried in the Clyde for a considerable length of time on Thursday, 27th of June last, first with injection, and then with my patent condensers; when the latter were applied, (all other things remaining precisely the same) they produced an increase of vacuum of 3 inches of mercury, as shown by both the barometer and the indicator; and for the accuracy of this statement I appeal to Robert Sinclair, Esq., of Greenock, the manufacturer of that fine pair of engines; T. Lloyd, Esq., inspector of machinery to the Admiralty was also on board during the trials, and applied the indicator.

I have no doubt but the future performances of the *British Queen* will fully prove the great importance of this improvement on the steam-engine, as relates to increase of power, greater safety and durability of the boilers (owing to their being uniformly supplied with pure distilled, instead of salt water), and many other collateral advantages, and I am persuaded that the Directors of the British and American Steam Navigation Company will congratulate themselves in having exercised a sound discretion in availing themselves of apparatus, the sterling value of which has been fully proved by nearly six years of experience on board many of the largest class of steam vessels.

I am, Sir,
Yours respectfully,
SAMUEL HALL.

18, Kings Arms-yard, July 5, 1839.

ESTABLISHMENT OF MAGNETIC OBSERVATORIES, AND NAVAL EXPEDITION FOR MAGNETIC PURPOSES.

We are glad to learn, that the following interesting Report (which is unfortunately without a date) has produced its desired effect upon her Majesty's Ministers, who have appointed three officers of Artillery, with adequate attendants, to go respectively to Montreal, to the Cape of Good Hope, and to St. Helena, to make the experiments on the variations, and dip of the needle, and the intensity of magnetism, frequently and simultaneously each day, for three years; Capt. Ross (the nephew of Sir J. Ross) is also appointed to go out in a ship for the same period, and make similar experiments and observations at various places specified by the Committee of the Royal Society. We shall rejoice if the results are as curious and valuable as the scientific projectors anticipate.

Report of a Joint Committee of Physics and Meteorology referred to, by the Council of the Royal Society, for an opinion on the propriety of recommending the establishment of fixed magnetic observatories, and the equipment of a naval expedition for magnetic observations in the Antarctic Seas, to Her Majesty's Government, and to report generally on the subject: together with the Resolutions adopted on that Report, by the Council of the Royal Society.

Report.

The subject of terrestrial magnetism has recently received some very important accessions which have materially affected not only the point of view in which henceforward it will be theoretically contemplated, but also the modes of observation which will require to be adopted for completing our knowledge of the actual state of the magnetic phenomena, and furnishing accurate data for the construction and verification of theoretical systems. It was for a long time supposed that the changes in the position assumed by the needle at any particular point on the earth's surface might be conceived as resulting from regular laws of periodicity, having for their arguments, 1st, a great magnetic cycle of several centuries, depending on unknown, and perhaps internal movements or relations; and 2ndly, on the periodic alternations of heat and cold depending on the annual and diurnal movements of the sun. The discovery of the affection of the needle by the aurora borealis, and of the existence of minute and irregular movements, which might be referred either to unperceived auroras or to other local and temporary causes, sufficed to show that the laws of terrestrial magnetism are not so simple as to admit of this summary form of expression; and the important discovery, first announced, we believe, by Baron Von Humboldt, that those temporary changes take place simultaneously at great distances in point of locality, a discovery which has since been remarkably confirmed and extended to very great intervals of distance, so as to include the whole extent of the Euroopean continent, by Gauss and Weber, and their coadjutors of the German Mag-

netic Association, has sufficed to show that the gist of the inquiry lies deeper, and depends upon relations far more complex, while at the same time the dominion of what might previously have been regarded as local agency, would require, in the new views consequent on the establishment of these facts, to be extended far beyond what ordinary usage would authorize as a just application of that epithet.

For a long time in the history of terrestrial magnetism the variation alone was attended to. The consideration of the dip was then superadded; but the observation of this element being more difficult and delicate, our knowledge of the actual and past state of the dip over the earth's surface is lamentably deficient. It has lately appeared, however, that this element can be observed with considerable approximation, though not with nicety, at sea, so that no reason subsists why materials for a chart of the dip analogous to that of variation should not be systematically collected. Lastly, the intensity has come to be added to the list of observanda; and from the great facility and exactness with which it can be determined, this branch of magnetic knowledge has in fact made most rapid progress.

These three elements, the Horizontal Direction, the Dip, and the Intensity, require to be precisely ascertained before the magnetic state of any given station on the globe can be said to be fully determined. Nor can either of them, theoretically speaking, be said to be more important than the others, though the direction, on account of its immediate use to navigators, has hitherto had the greatest stress laid upon it, and been reduced into elaborate charts. A chart of the lines of total intensity has been recently constructed by Major Sabine.

All these elements are, at each point, now ascertained to be in a constant state of fluctuation, and affected by those transient and irregular changes which are above alluded to; and the investigation of the laws, extent, and mutual relations of these changes is now become essential to the successful prosecution of magnetic discovery, for the following reasons.

1st. That the progressive and periodical being mixed up with the transitory changes, it is impossible to separate them so as to obtain a correct knowledge and analysis of the former, without taking express account of and eliminating the latter, any more than it would be practicable to obtain measures of the sea-level available for an inquiry into the tides, without destroying the irregular fluctuation produced by waves.

2ndly. That *the secular magnetic* changes *cannot be concluded from comparatively short series of observations* without giving to those observations extreme nicety, so as to determine with *perfect* precision the mean state of the elements at the two extremes of the period embraced, which, as already observed, presupposes a knowledge of the casual deviations.

3rdly. It seems very probable that discordances found to exist between results obtained by different observers, or by the same at different times, may be, in fact, *not* owing to error of observation, but may be due to the influence of these transitory fluctuations in the elements themselves.

4thly and lastly, Because the theory of these transitory changes is in itself one of the most interesting and important points to which the attention of magnetic inquirers can be turned, as they are no doubt intimately connected with the general causes of terrestrial magnetism, and will probably lead us to a much more perfect knowledge of those causes than we now possess.

Actuated by these impressions, on the occasion of a letter addressed by Baron Von Humboldt to His Royal Highness the Duke of Sussex, P.R.S., the Council of this Society, on April 13, 1837, resolved to apply to Government for aid in prosecuting, in conjunction with the German Magnetic Association, a series of simultaneous observations; and in consequence of an application founded on such their resolution, a grant of money was obtained for the purchase of instruments for that purpose. By reason, however, of the details and manipulations of the methods then recently introduced into magnetic observations by Gauss being at that time neither completely perfected, nor their superiority over the old methods fully established by general practice, the precise apparatus to be employed in these operations was not at the time agreed upon, and was still under discussion, subject to the report of the Astronomer Royal on the performance of an instrument on Gauss's principle established at Greenwich, at the time when the subject in its present more extended form was referred by the Council to this Joint Committee, so that the grant in question has not, in point of fact, been employed or called for. The Committee consider this as in some respects fortunate, as in consequence of the delay time has been given for a much maturer consideration of the whole subject; and should it now be taken up as a matter of public concern, they consider that it will be necessary to provide for a more continuous and systematic series of observations, by observers regularly appointed for the purpose, and provided with instruments and means considerably more costly than those contemplated on the occasion in question.

On the general advisableness of calling

for public assistance in the prosecution of the extensive subject of terrestrial magnetism, in both the modes referred to them for their consideration, (viz. by magnetic observatories established at several stations properly selected on land, and by a naval expedition expressly directed to such observations in the Antarctic Seas,) your Committee are fully agreed. They consider the subject to have now attained a degree of theoretical as well as of practical importance, and to afford a scope for the application of exact inquiry which it has never before enjoyed, and which are such as fully to justify its recommendation by the Royal Society to a revival of that national support to which we are indebted for the first chart of variations constructed by our illustrious countryman Halley in A.D. 1701, on the basis of observations collected in a voyage of discovery expressly equipped for that purpose by the British Government.

As regards the first branch of the question referred to their consideration, they are of opinion that the stations which have been suggested to them, viz. Canada, St. Helena, the Cape, Van Diemen's Land, and Ceylon (or Madras), are well selected, and perhaps as numerous as they could venture to recommend, considering the expense which would require to be incurred at each, and that in each of these stations it would be desirable, 1st, That regular hourly observations should be made (at least during the daytime) of the fluctuations of the three elements of variation, dip, and intensity, or their equivalents, with magnetometers on the more improved construction, during a period of three years from their commencement.

2dly. That on days, and on a plan appointed, agreed on in concert with one another, and with European observatories, the fluctuations of the same elements should be observed during twenty-four successive hours, strictly simultaneous with one another, and at intervals of not more than five minutes.

3dly. That the absolute values of the same elements shall be determined at each station, in reference to the fluctuating values above mentioned, with all possible care and precision, at several epochs comprehended within the period allowed.

4thly. That in the event of a naval expedition of magnetic discovery being dispatched, observations be also instituted at each fixed station, in correspondence with, and on a plan concerted with the Commander of, such Expedition.

As regards the second branch of the subject referred to them, viz. the proposal of *an Antarctic voyage of magnetic* research, they are of opinion, as already generally expressed, that such a voyage would be, in the present state of the subject, productive of results of the highest importance and value; and they ground this opinion on the following reasons:—

1st. That great and notorious deficiencies exist in our knowledge of the course of the variation lines generally, but especially in the Antarctic seas, and that the true position of the southern magnetic pole or poles can scarcely even be conjectured with any probability from the data already known.

2ndly. That our knowledge of the dip throughout those regions, and the whole southern hemisphere, is even yet more defective, and that even such observations of this element as could be procured at sea, still more by landing on ice, &c., would have especial value.

3rdly. That the intensity lines in those regions rest on observations far too few to justify any sure reliance on their courses over a large part of their extent, and over the rest are altogether conjectural. Nevertheless that there is good reason to believe in the existence and accessibility of two points of maximum intensity in the southern as in the northern hemisphere, the attainment of which would be highly interesting and important.

4thly. That a correct knowledge of the courses of these lines, especially where they approach their respective poles, is to be regarded as a first and, indeed, indispensable preliminary step to the construction of a rigorous and complete theory of terrestrial magnetism.

5thly. That during the progress of such an expedition, opportunities would of necessity occur (and should be expressly sought) to observe the transitory fluctuations of the magnetic elements in simultaneous conjunction with observations at the fixed stations and in Europe, and so to furnish data for the investigation of these changes in localities very unlikely to be revisited for any purposes except those connected with scientific inquiries.

Your Committee, in making this Report, think it unnecessary to go into any minute details relative to the instruments or other materiel required for the proposed operations, still less into those of the conduct of the operations themselves. Should such be required from them, it will then be time to to enter further into these and other points, when the Committee will most readily devote themselves to the fullest consideration of the subject.

J. F. W. Herschel.
Chairman of the Joint Physical and Meteorological Committee.

Resolutions of the Council.

1. That this Report be received and approved.

2. That the Council, deeply impressed with the importance of the scientific objects which might be attained by an Antarctic Expedition, particularly by the institution of magnetic observations in southern regions, do earnestly recommend that Her Majesty's Government be pleased to direct the equipment of such an expedition.

3. That the imperfect state of our present knowledge of the amount and fluctuations of the magnetic elements, renders the establishment of fixed magnetical observatories, for a limited time, at various points of the earth's surface, highly desirable, particularly in Canada, St. Helena, Van Diemen's Land and Ceylon, and at the Cape of Good Hope, and that the Council do earnestly recommend Her Majesty's Government to cause such observatories to be established.

4. That a deputation, consisting of the President, Treasurer, and Secretaries of the Society, Sir John F. W. Herschel, the Chairman, and Major Sabine and Mr. Wheatstone, the Secretaries of the joint Committee of Physics and Meteorology, be requested to communicate the above Resolutions to Lord Melbourne, and to urge on the Government the adoption of the measures therein proposed.

REPORT OF CAPTAIN PRINGLE, R. E., AND JOSIAH PARKES, ESQ., C. E., ON THE CAUSES AND MEANS OF PREVENTION OF STEAM-BOAT ACCIDENTS.

(Instances of Explosions, continued from page 140).

Union.—This explosion is attributed, with great apparent reason, to the instantaneous disengagement of an immense volume of steam produced by the oscillation, or *listing* of the vessel; the boiler, a rectangular one, being at the time short of water, and the upper plates of the furnaces, on the higher side of the vessel, being probably red-hot, or nearly so. (See *Mech. Mag.* vol. xxvii, p. 189.)

No ordinary number of safety-valves could have liberated the amount of steam thus suddenly generated.

The primary cause of this accident was *carelessness*, in allowing the flues to be bare of water. It does not appear that glass water-gauges were affixed to this boiler, only gauge-cocks, which frequently give false indications of the level at which the water really is within the boiler, particularly when the vessel is not on an even keel.

Engine-men often have the water very low in the boilers at starting, to save the labour of pumping by hand, and several explosions have been produced by their trusting to its not becoming too low, before setting on the engine to do the work for them. Mr. J. S. Russell recommends a plan for supplying the boilers with water when the steam is up, but the engine not at work, others recommend a small steam-engine for this purpose.

Graham.—The explosion of the *Graham's* boiler occurred near Grimsby, whilst she was lying alongside the steam-vessel, the *United Kingdom*. There is no doubt, from the evidence *given on the trial of* the *engine-man (who was found guilty* of *manslaughter, but never brought up* for judgment), that an excessive pressure of steam had accumulated during the stoppage of the engine for some minutes; the fires continuing in full activity, and all the weights remaining on the *(miscalled)* safety-valves. The shell of the boiler (which was of the rectangular form, and, from our inquiries, appears to have had many stays) was projected, like those of the *Union* and *Earl Grey*; six persons lost their lives, and many were seriously injured.

Vivid.—The explosion of the *Vivid's* boiler at North Shields, by which two persons lost their lives, took place under peculiar circumstances, which should be known, and serve as warnings to the commanders, engine-men, and firemen of all steamers.

This vessel belonged to four persons, brothers; was employed both for conveying passengers, and as a tug in the Tyne, like most of the numerous small steamers in that river. They had engaged, on the morning of the accident, to take a vessel out to sea, and were fast to her for that purpose, but finding something amiss with the boiler, they abandoned their intention for the day, and proceeded to draw the fires, which they had no sooner completed, or nearly so, than the internal fire-tube of the boiler ruptured, and the boiling water and steam scalded to death two of the brothers, who had acted (as they thought) with due caution.

Had they *extinguished* the fires by a *jet of water*, when they suspected danger, in the manner so judiciously recommended by Mr. Harvey, Mr. J. S. Russell, and others, all would have been well. The process of drawing the fires augmented the heat in the first instance, instead of diminishing it; the

pressure of the steam must have been, at this precise moment, in equilibrium with the strength of the boiler, and required but a small increase to overcome it. The men, unfortunately, gave this increase, and a rupture of the fire-tube took place on its underside, both boiler and tube being cylindrical. The tube, at the ruptured part, was subsequently discovered (though exposed only to the action of water or mud, not to fire,) to have been worn very thin, corroborating the statement by Mr. Golightly "that the water of the Tyne seems to contain some corrosive principle in its deposit, as the under parts of the fire-tubes and flues, where the deposit settles, become thin, by being eaten away, sooner than the upper part, which is exposed to the heat of the fires."

It is noticed by Mr. Harvey, in relating a slight rupture of a boiler, that the reverse of this takes place in the Bristol Channel: he says, "On examination, we found the plate which gave way, not one-sixth of an inch in thickness, and the *top* of the boiler throughout very much worn; this, I would mention, is very peculiar to boats plying to Bristol, that the *interior* of the boilers from the lowest water-line upwards, decays earlier than I have seen elsewhere. I have seen, in 18 months, the heads of rivets worn completely away."

These last-cited phenomena, should, wherever they are known to occur, or are suspected, induce the owners of vessels to examine carefully the state of the boilers, and have them very frequently cleansed and examined.

An uninstructed *engine-man* would, very probably, *draw* his fires in an emergency similar to that of the *Vivid;* but an *engineer* would prevent him, and make him *extinguish* them. Mr. Gibson, of Hull, well observes, "Steam navigation has advanced more rapidly than men of experience and knowledge of machinery have been found to conduct it; hence we often find, in river packets in particular, men advanced to the post of engineer who are mere automatons, ignorant of the first principles of the machine over which they preside, and who, in case of any derangement, do, from ignorance of the result, the very thing which they ought to have avoided, thereby creating, rather than averting danger, or accident." Commanders of steam-vessels should carefully collect and register such facts as these, and every fact bearing on the derangements to which boilers, engines, and their machinery are liable; they should be acquainted with the best engineering appliances in the event of danger, and form a code of instructions for the guidance of their men in various difficult circumstances which may present themselves.

Victoria.—The explosion, collapse, rupture, or by whatever name the two accidents may be called, which happened to the boilers of this vessel last year, arose from one cause in each instance, viz., malconstruction.

The malformation of these boilers prevented the free egress of the steam from the water, which were so commingled, that the true level of the water could seldom be ascertained; much water must also have been carried over with the steam into the cylinders; but the specific cause of the two explosions was the inadequate strength of the large internal cylinder to sustain the pressure upon it; and it ruptured at the bottom, below the fire, where there was plenty of water, but where the pressure was the greatest. (See *Mechanics' Magazine*, vol. xxix, p. 340.)

We had an opportunity of seeing these boilers in pieces at Hull, and found the plates of the ruptured cylinder to be, in every part, five-sixteenths of an inch in thickness, not so little as one-fourth, as stated before the coroner.

These two explosions occasioned the death of fourteen men, all of whom were employed about the boilers or engines.

Norwich.—This vessel stands the first in our schedule of accidents, as a case of explosion, in 1817; it is, also, supposed to have been the first which occurred in this country, on board of a steam-boat. The engine was of the *high-pressure* kind, i. e. *non-condensing*, and using steam of highly elastic force; the boiler of cast-iron. We are not aware that any similarly constructed engines are now afloat, and believe them to have been long since abandoned.

We find, on analysing the explosions contained in the list, that by far the greatest number have taken place in steamers belonging to ports, where the practice of engine-makers is to apply *exposed*, and *accessible* valves. Explosions have been most numerous in the Clyde, or in Scotch-built vessels, both river, and sea-going. The *Corsair*, *Fingal*, and *Antelope*, are of the latter class; the *Earl Grey*, *James Ewing*, *James Gallocher*, *Hercules*, *and Dumbarton Castle*, of the former.

The next greatest number have occurred in the Humber and Tyne steamers, where the safety-valves are similarly constructed; being five instances in river-steamers, and the *Victoria's*, a sea-going vessel, on two occasions; at Liverpool, two, among the river-steamers, which had *exposed* valves. We did not hear of, or discover any Liverpool-built and engineered sea-going vessel having exposed, or accessible valves; nor does it appear that any accident of an ex-

plosive nature has happened to them; and we have not to record a single case of explosion of any Thames-built boiler, in passenger-vessels of any kind, nor in any other, excepting in a small experimental one, mentioned by Messrs, J. Seaward and Co. This freedom from explosion in the Thames is attributed by Messrs. Maudslay and Field principally, to the practice of using *inaccessible* and *sufficiently large* safety-valves.

Safety-valves are often tampered with, and weighted by the working engineers, much beyond the pressure originally assigned by the makers of the engines, in order to gain power and speed. Proof of this is given in the instance of the *James Gallocher*; and Mr. Fawcett, the eminent Engineer of Liverpool, states that, "he has known valves—originally loaded at four pounds per square inch—to have been afterwards altered by some *blacksmith*, so as to give the engine-man power to load them as he pleased; and he believes them to have done so even to 20 pounds to the inch. The safety-valves of the *Duke of Bridgewater*—a Liverpool river-boat—were originally made inaccessible; they were altered so as to be fastened down, like the *Earl Grey's*, at the pleasure of the engine-man, and the boiler consequently exploded, killing two persons, and seriously injuring many more.

There is a very general deficiency both in river and sea-going steamers—particularly in North Britain—of glass water-gauges, and steam-pressure gauges; instruments absolutely essential to the safety of boilers, and used in all well-appointed vessels. Captain Bain observes, that "the boilers of many vessels are without these simple instruments, and the engineers and firemen, when doubtful of the accuracy of the cocks, try to ascertain the height of the water, by hitting the boiler with a stick or a hammer, &c."

Explosions are so destructive of life, and their occurrence occasions so great a distrust of steam-vessel conveyance, that we have thought it advisable to give a separate list of those accidents, with such observations upon them, and the boilers as are warranted by ascertained facts.

Particulars of Explosions, and form of Boilers.

Date.	No. of Reference to the Schedule of Accidents.	No. of Accidents.	Name of Vessel.	Form of Boiler.	No. of Lives lost.	Personal and other Injuries.
1817	1	1	Norwich	cylindric ..	9	many persons injured.
1824	4	2	Eagle	not known..	1	not known.
1824	5	3	Duke of Bridgewater.	rectangular..	2	many persons injured.
1825	6	4	James Ewing	ditto . ..	1	not known.
1826	10	5	Graham	ditto . ..	6	many persons injured.
1827	11	6	Fingal	ditto . ..	2	not known.
1828	14	7	Corsair	ditto . ..	1	ditto.
1828	17	8	Magdalene	ditto . ..	—	40 pigs scalded to death in the hold.
1829	20	9	Dumbarton Castle ..	ditto . ..	—	one person injured.
1830	24	10	Hercules	ditto . ..	—	ditto.
1831	33	11	Royal William . ..	ditto . ..	—	no harm done, except to the boiler.
1834	45	12	Herald	cylindric ..	—	ditto ditto.
1835	48	13	Earl Grey	rectangular..	10	many persons injured.
1836	57	14	Freedom	cylindric ..	1	the vessel was sunk.
1837	63	15	Union	rectangular..	24	many persons injured.
1838	73	16	Victoria	cylindric ..	5	others injured.
1838	74	17	Victoria	ditto . ..	9	ditto.
1838	75	18	James Gallocher ..	rectangular..	2	several persons injured.
1838	76	19	William Stanley . ..	ditto . ..	—	ditto.
1838	77	20	Antelope	ditto . ..	—	18 cattle destroyed in the hold.
1838	79	21	Vivid	cylindric ..	2	boiler worn very thin in the ruptured part.
1839	91	22	Urgent	rectangular..	—	eight or nine persons severely scalded.
1839	92	23	Morning Star	cylindric ..	2	boiler worn very thin.
				Total....	77	

It thus appears that 7 explosions have occurred in cylindric boilers.
" 15 ditto .. .. .. rectangular boilers.
" 1 ditto, the *Eagle*—form of boiler not ascertained.

Total.... 23

19 Explosions happened whilst the vessels were stopping, or on the instant of setting the engines in motion.
3 Ditto, whilst steaming.
1 *Ditto, the Antelope*, not ascertained.

23

Effects of Explosion.

Cylindric Boilers.—The boiler of the *Norwich* (cast-iron) was broken into many fragments by the explosion, and the vessel destroyed; the end was blown out of the *Freedom's*, and the vessel sunk; those of the *Vivid* and *Morning Star* burst inwards on the under part of the fire-tube, where both were worn very thin. The *Herald's* opened on the top, also corroded very thin. The *Victoria's* twice ruptured inwards, on the under part of the fire-tube; the iron apparently good, but the cylinder too large for the strength of material and pressure upon it.

Rectangular Boilers.—Of these, the outer shells of the *Graham*, *Earl Grey*, *Union*, and *Duke of Bridgewater*, were more or less ruptured, and projected, forcing up the decks, &c. The vessels were much shattered in several of the other explosions, which occasioned fissures in the boilers, either above or below the water-level; the greater number, so far as ascertained, occurring below the water-level; in some cases opening the shell, and bursting into the cabins; in others, rupturing the flues, and doing mischief chiefly amongst the engine-men and firemen, according to the respective strength of the shells of the boilers and flues.

The *Earl Grey's* boiler had no stays; the *Union's*, *Graham's*, *Magdalene's*, and others, had stays, but neither their number nor arrangement can now be ascertained.

Safety-valves.—In two instances—the *James Gallocher* and *Morning Star*—it is proved, that the steam was blowing off through the safety-valves at the time of the explosion, showing the valves to have had an insufficient area. In the cases of the *Graham*, *Earl Grey*, and others, it is proved that the valves were either fastened down, or too heavily loaded to rise at the pressure which burst the boilers.

The destructive effects of an explosion often render it impossible to determine, with sufficient accuracy, either the area of the safety-valves, compared with the power of the boiler, or the pressure at which the explosion took place. In the event of a coroner's inquest, these important facts are rarely inquired into; it is no one's business to ascertain them; jurors understand nothing about the matter, and are mystified by contradictory statements. In several of the cited cases, the spindles of the valves had been bent, or otherwise set fast; in that of the *Morning Star*, though the valve rose, and allowed some of the steam to escape, we are informed by Mr. Greener, who examined the boiler minutely, and gave *evidence on the inquest, "that it was so rusted, it appeared not to have acted for years."* Its area was also very inadequate, havingly only about one square inch of aperture to four-horse power; the engineers of the Thames steamers usually give an area to their safety-valves of one square inch for each horse-power—a safe and excellent practice; but we found the dimensions of safety-valves so restricted in the vessels of some ports, that only one-fifth of a square inch was allowed to each horse-power, an area so insufficient, that though the valves might be well made, and act freely, the pressure of steam would continue to increase when the engine stopped, and attain an elasticity exceeding the resistance of the boiler, though steam were continually escaping. An explosion is the necessary consequence.

Height of Water in the Boilers.—It is also difficult to obtain, after these accidents, credible information as to the sufficiency of water in the boilers, at the moment of explosion. It is probable—from the general absence of glass water guages, in the class of steamers whose boilers have chiefly exploded—that testimony on this point is not to be relied upon. The *Union's* is a clear case of deficiency of water, combined with overheated flues, and an oscillatory movement of the vessel. The subject of the quality of iron used for boilers is far from occupying the attention it merits either by boiler-makers, engineers, or steam-vessel owners. A piece of the *Morning Star's* boiler, in our possession, taken from the ruptured part, shows it to have been corroded to two-tenths of an inch in thickness, its original strength having been half an inch, and the iron very bad. The fire-tube ruptured at a pressure of about 23lbs. per square inch; its form was elliptic, three feet, by two feet six inches; the external shell, cylindric, six feet diameter.

Fires.

Tweedside.—The danger to the *Tweedside*, on a pleasure trip, originated in going to sea with a defective boiler, which became red hot, and set fire to the vessel. The passengers were only saved by the fortunate appearance of the *Royal Adelaide* steamer. Persons acquainted with the possible, and highly probable consequences to a boiler in such a state, will only wonder that the vessel, and all on board, were not destroyed by an explosion.

Vessels originally built, generally used, and only fit for river navigation, are frequently selected for "pleasure trips," or excursions to sea, in the summer season. We were informed (*see* also Captain Denham) that the Liverpool ferry steamers frequently make "pleasure trips" out to sea, unprovided with binnacle, compass, or a boat that would swim; and many strong representa-

tions were made to us in Scotland of the insufficiency of the *river* steamers of the Clyde, to encounter bad weather on their summer tours.

Suffolk.—This is a case of imminent danger at sea, from the spontaneous combustion of coals on board. She was saved by the judicious management of Mr. George Bayley, now one of the surveyors to Lloyd's, in the port of London.

The frequency of similar occurrences (of which this is only an instance) will be found attested by almost all our correspondents.

The spontaneous ignition of coal originates in carelessness, in the bad construction of coal-bunkers, in allowing old coal to remain in moist and warm situations, and stowing coals on the tops and about the sides of boilers.

In the case of the *Suffolk*, it will be seen that she was unprovided with a fire-engine or hose, or tools for scuttling the deck, a species of equipment essential to safety.

The following is an instance of miserable deficiency in this description of stores, and of the want even of the commonest utensils on board many steamers:—

Falcon.—The cabin-hatch of this vessel took fire in the Humber, about a mile from shore, two days before we arrived at Hull.

We mention it as an instance of great negligence on the part of owners. There were no fire-buckets on board, nor any means of baling or pumping water. She came into port on fire, with many passengers, and it was extinguished by the aid and with the buckets of the inhabitants.

Numerous fires occur from the proximity of wood-work to funnels, &c.

Medway.—This vessel was twice on fire from this cause; on the second occasion burnt to a wreck, and two persons were drowned by leaping overboard.

The charring of timbers *in the wake*, or proximity, of the boilers, is alluded to by the ship-builders, and many other correspondents, as a frequent cause of fire, and injury to the vessel.

We here beg to draw particular attention to the excellent arrangements and practice adopted by the City of Dublin Steam Packet Company of Liverpool, and in well-appointed vessels of other companies, to obviate the evils arising from these fertile sources of danger to the vessel, and of expense to the owners. We refer to their use of iron beams and deck plates over the boilers, and about the funnel; of the complete separation of the boilers from each other, and from the sides of the ship; of lining the ship's sides with lead, covered again with iron, in the proximity of the boilers; of protecting the *boilers from spray, rain,* and the contact of coals, by a shell of iron; and the practice of sweeping down all the remaining coal into the bunkers, or iron coal-boxes, on the termination of each voyage.

The suggestions also of Messrs. Maudslay and Field, and others, that pipes from the boilers should be so arranged as to convey steam into the coal receptacles, and other parts of the vessels, in the event of fire, would give great additional security.

Collisions.—Collisions between steam-vessels, and between them and other craft, occur so frequently in crowded waters; they are often so fatal to life, and so generally attended with litigation, and expense in repairing damage, that the want of a law to diminish the evil, is the subject of complaint by nearly all our correspondents. Collisions occur both by day, and by night, at sea as well as in rivers. They commonly arise from the absence of an universal understanding as to the "*rule of the road*" to be observed by vessels, in meeting and passing each other, and from the absence of an universal system of *night-lights* or signals.

The practice is at present regulated only by custom, or by the bye-laws of different ports, which custom, being various, is productive of serious collisions even on the high seas.

The appendix contains the rules and regulations adopted by the Trustees of the Clyde; those promulgated by the Corporation of the Trinity House, Hull, for regulating the navigation by steam in the Humber, Ouse, and Trent, and the laws enforced in the port of Tyne. By the two first, vessels meeting are joined to *starboard*, and by the last, to *port* their helms.

Many pertinent remarks on this subject will be found in the replies amongst others of Captain Denham, R. N., who expresses himself much to the point. Of the custom at Liverpool, he says, "All, however, attend to one rule, and that is, in passing each other on their *starboard* sides; but I understand the reverse is observed at other ports, which has naturally been attended with collision when a Liverpool vessel gets amongst them."

This important question underwent the scrutiny of the "Commissioners appointed to inquire into the Laws and Regulations relating to the Pilotage of the United Kingdom," in 1835; their "proposed regulations for the Navigation of Steam-vessels," and the arrangement of signal-lanterns recommended by them, have not yet been acted upon.

Almost every imaginable variety of lights is in use amongst steam-vessels.

Mr. Shaw, engineer to the City of Dub-

lin Company, Liverpool, introduced a system of night-signals in that company's vessels in 1834, which has since been adopted by her Majesty's packets at Liverpool, and by some other owners. This system consists of the exhibition of one *white* light at the foremast head, one *white* light on the *starboard* paddle-box, and one *red* light on the *larboard* paddle-box. These are all resplendent and powerful lights. The mast-head light is transmitted through a large solid glass lens, so shaped and disposed that the light ceases to be visible abaft the beam. The starboard paddle-box light is also transmitted through a solid glass lens; the larboard light through a hollow glass lens, containing a red mineral solution. These are placed in houses attached to the paddle-boxes, and the rays are projected at an angle of about 35 degrees with the keel, so as not to dazzle the look-out men on the forecastle. They are visible at great distances.

By reference to our schedule of accidents, it will be seen that, in 1825, a collision took place in the Clyde *at night* between two steamers, the *Comet* and *Ayr*, by which 62 persons were killed or drowned. Mr. Cumming states that the cost of repairs to the *Mount-Stuart Elphinstone*, which ship sustained *at night* a serious collision in the Clyde, in 1836, with the steamer *City of Glasgow*, amounted to 1,039*l*. Mr. Shaw states that the cost of repairing the *Royal William*, after her collision with the *Tagus*, in 1837, *also in the night*, was 1,001*l*; and this, notwithstanding the division of the *Royal William* into water-tight compartments, which alone saved her from going to the bottom, with probably all on board. These are merely instances of constantly recurring accidents of a similar nature, and many costly steamers and sailing-vessels have been sunk or destroyed by collisions. The *Apollo* steamer was run down *at night*, and sunk by the *Monarch*, in 1837, in the Thames for want of proper lights.

The same causes which produced the first collision remain still in full activity, and it is fearful to contemplate the loss of human life which the absence of a law on these subjects may produce at any moment.

There is yet another important point to be considered, as bearing on the means of preventing collisions.

A *distinguishing sound* should be provided on board *steam-vessels*, as an *alarm*, to notify their proximity to other vessels at night, on occasion, but more particularly during fogs or thick weather, when lights can only be seen on a very near approach. The want of such regulation is alluded to by several of our correspondents, and a means is also suggested for accomplishing the end. Sailing vessels are generally provided with some instrument for making a noise, to which resort is had when circumstances require it; viz. bells, horns, gongs, &c. A steam vessel carries with it an agent more powerful than any of these contrivances, and one which could not fail in notifying its approach, *distinctively* from every class of vessel, and from a much greater distance than bells, &c.; a circumstance of no slight consequence, when the greater velocity of a steamer is considered. The *steam-whistle* in common use, attached to locomotive engines, if applied to the boiler of a steam-vessel, would completely fulfil the desired end. All that is required is a small pipe opening into the steam-chest, and brought up on deck, with the whistle on the top of it, in a convenient position to be used when the commander may order it. By simply turning the handle of a cock, a prolonged sound is produced, or a succession of sounds, on opening and shutting the cock at short intervals. The sound from the whistle of a locomotive engine has frequently been heard more than two miles. We have made particular inquiries as to the degree of sound producible with low pressure, compared with high-pressure steam, and learn that this whistle may be constructed so as to be equally as effective with the one, as with the other.

Our list contains two instances of steamers sunk by collision, *during fogs*, in one year, 1836; viz., the *Rob Roy*, and *Red Rover*, both in the Thames; and the digest of a list reported to us by the Waterman's Company, London (page 17), exhibits a total of 71 accidents to vessels of all kinds, from collision with steamers, in the Thames, during three years only.

Boilers and Engines.

Boilers.—That Boilers are very frequently continued in use till they become dangerously thin, and that they are frequently deficient in safety apparatus, is a fact not only evidenced by the Table of Explosions, and instances given, but attested by a large majority of our correspondents. We were shown several in the yards of engine and boiler-makers, which (to use their own expression) "might be walked through;" indeed, the hand might be pushed through some boilers which we examined, but recently taken out of steam-boats. Mr. Shaw states, that "the boilers of the *Fingal*, in 1835, were so weak that they had to be shored between the deck, and the tops of them, which expanded and contracted like a pair of bellows." Captain Bain writes, that "he has frequently had occasion—sometimes under very trying circumstances—to stop rents in boilers by temporary expe-

dients; that he has witnessed it in other vessels, and has seen boilers worked till they were as thin as paper, &c." Some boilers, in actual use, are only kept tight by the deposit of mud, concretions of salt and sand, &c. between the flues: these obstructions to the passage of heat are not removed, as the metal of the boilers would give way, and they must then necessarily undergo repair, which is delayed till they will no longer hold together, or till ruptures occur, and have produced mischief. The Appendix contains abundant testimony to negligence, and ill-judged economy of this nature.

The explosion of deteriorated boilers is not the greatest disaster to be dreaded from steamers so ill-provided; under the head of Wrecks and Founderings, the calamitous consequences of boilers failing at sea are still more fearfully exemplified.

Nearly the whole of the passenger, and no inconsiderable portion of the merchandize coasting traffic of the British isles, is carried on by steam vessels, the rapidly increasing number of which will presently be shown. It is impossible to determine, in the absence of official record, whether the number of accidents has increased in a greater ratio than that of the steamers; but our schedule exhibits an annual increase of disasters, and shows that nearly the half of them has occurred within the last three years; and that from the beginning of 1838 to the present time—a period of fifteen months only—no fewer than twenty-two accidents have happened. They consist of—

11	wrecks, founderings, or imminent peril	117	lives lost.
8	explosions	20	ditto, and many persons injured.
2	collisions	—	
1	fire	—	
22		137	

In addition to the amount of human life sacrificed, 688 animals were thrown overboard, or scalded to death.

Seven of the vessels were totally lost, four of which are traced to have had defective boilers or engines, and others had to undergo costly repairs.

It results from the opinions expressed by the engineering class of our correspondents, that great additional safety is obtained by employing several boilers, distinct from each other, rather than one only, or two boilers connected together; many dangers are avoided by this method. Independently of the obvious security arising from the means thus afforded of *shutting off* a disabled boiler, and even of repairing it, whilst the motion of the engines is continued by the others, this arrangement possesses many other advantages, and cannot be too strongly recommended for general adoption. Mr. Shaw gives a forcible illustration of the value of distinct boilers, in his account of the salvation of the *Thames*, after her perilous collision with the *Shannon*.

Engines.—The machinery by which a steam vessel is propelled appears, notwithstanding its comparative complexity, to be maintained, generally, in better condition than the boilers. The foundering of the *Venus* in 1829 is an instance of a disaster occasioned by the breaking of the connecting rod; the more common derangements are fractures of cross-heads, beams, cranks, crank-pins, &c., of which we both saw and heard many examples; but the practice of using a pair of engines, particularly in sea-going steamers, is a great guarantee against shipwreck, as, in the event of one engine being disabled, the other can safely work the vessel. Duplicates of the parts most liable to fracture should always be found amongst the stores of a steamer.

Several wrecks have been referred to by our correspondents which might have been averted, had the paddle-wheels been furnished with *disengaging apparatus*, which is effected too slowly and clumsily by removing the floats—an operation, also, difficult of accomplishment, in tempestuous weather. British engineers are not likely to leave so great a desideratum long unsupplied; several plans for its accomplishment are already in partial use.

Summary of Causes of Accidents.

The primary causes of nearly all the accidents which occur to life and property on board steam vessels, may be classed as follows:—

	Causes.	Instances.
Of Wrecks, foundering, or imminent peril of the same.	Defectiveness of hull; intoxication of captain and mate	*Rothsay Castle.*
	" hull, boilers and engine	*Northern Yacht.*
	" boiler, cables and anchors	*Forfarshire.*
	" boilers, cables and sails	*Ardincaple.*
	" boilers, and crankness	*Aurora.*
	" boilers, engine, or vessel	Erin.
	" boiler or engine, and sails	Killarney.
	" hull, cables, engine and boiler	Abbey.

Of Explosions.....	Ignorance, carelessness, recklessness, and drunkenness of engine men. Bad construction, or insufficiency of safety-valves. Inattention to, or want of proper apparatus to denote the level of water, and pressure of steam in the boilers. Malformation of boilers to sustain pressure. Working old boilers too long, and at too great pressure. Bad materials, and bad workmanship of boilers.
Of Fires.....	Carelessness and want of cleanliness. Bad construction of coal receptacles. Stowing coals on the boilers, and against the undefended sides of the vessel. Placing boilers too near the decks and sides of the vessel. Defective state of the boilers. Want of fire-extinguishing apparatus.
Of Collisions.....	Want of an universal code of night signals. Want of a defined and compulsory "rule of the road." Racing. Carelessness, or neglect of look-out.

Amount of the Mercantile Steam-marine.

Before presenting, in a substantive shape, all the provisions we have to recommend for the protection of the public against the evils which arise from defects shown to have existed, and to be still existing, as respects the condition and management of numerous steam vessels, it is expedient to state the amount and importance of the actual mercantile steam-marine of the British empire. These data we shall proceed to determine as accurately as our means permit.

The following table gives, *approximately*, the numerical tonnage and power of steam vessels afloat: it will materially assist in forming a correct opinion of the deficiencies of the present, and of the great importance of an improved system of registration and regulations.

This table was commenced on perceiving that the custom-house returns were, necessarily, very imperfect; as the law does not oblige those steamers to be registered which ply only within the limits of a port. We took great pains to ascertain at the ports we visited, the number, tonnage, and engine power of the unregistered vessels. We discovered 83. Of these there are 37 plying in the Mersey, 26 in the Humber, 16 in the Thames, and four in the rivers on the east of Scotland, nearly all of which are used to convey passengers. There are, no doubt, many others unregistered at ports which we did not visit.

At some of the out-port custom-houses, returns were supplied to us, containing not only the registered tonnage, but that of the engine-room, with the power and number of engines on board many of the steamers; such entries being voluntarily made as a record of property. This is practised at Newcastle, Leith, and a few other ports, and is found to be useful to proprietors, mortgagors, and purchasers.

From these sources, and by obtaining from several companies and individuals correct returns of the entire tonnage and power of different sized vessels, we have been enabled to determine, with tolerable accuracy, the total amounts of tonnage and power, together with the proportions of the same according to the scale given in the table.

We also found that the custom-house registration of steamers supplies insufficient data of the relative amount and value of steam navigation in the different ports.

There are plying in the Humber, Ouse, and Trent, 25 registered, and 26 unregistered steamers.

At Glasgow and Greenock all which ply on the Clyde, or on the east coast of Scotland, are locally registered.

At Newcastle all are registered, most of them combining the two trades of conveying passengers, and towing ships.

At Liverpool 39 only are registered, 37 not registered; but we obtained a return of 152 steam vessels which use that port. Two Liverpool companies alone possess more vessels than the total number registered there. Of the large number of trading steamers between Ireland and Liverpool, some of which are registered in English, and some in Irish ports, we were informed that nineteen-twentieths are owned in Ireland.

Thus it is obvious that no complete return can at present be given of the number, tonnage, or power of steam vessels belonging to England, Scotland, and Ireland, separately, and we have consequently forborne to distinguish them, as many British vessels are registered at some Irish port, and *vice versa*.

The total number of British and Irish steam vessels, including those registered in Guernsey, Jersey, and Man, amounts to 766; of these 484 may be considered as river steamers and small coasters; and 282 as large coasters and sea-going ships.

The increase in 1837 over 1836, was 78; and that of 1838 over 1837, 59 registered vessels.

The impulse given during the past year to steam navigation, on the grandest scale hitherto attempted, by the successful voyages of the Transatlantic steam ships, *Great Western*, *Liverpool*, and *Royal William*, has caused several ships to be laid down of even a larger class, to be propelled by engines of still greater power. Every subsequent year

A Statement of the approximate Number, Tonnage and Power of Vessels belonging to the Mercantile Steam-marine of the United Kingdom and its Dependencies.—End of Year 1838.

	Number of Vessels per Custom-house Return, 1838.	Size of Vessels per Custom-house Return.	Registered Tonnage.	Tonnage of Engine-room, &c., not registered at the Custom-house.	Total computed Tonnage.	Computed amount of Horse Power.	Computed Power per Vessel.	Total computed Tonnage per Vessel.
	No.	Tons.	Tons.	Tons.	Tons.	Horse Power.	Horse Power.	Tons.
	256	below 50	6,106	10,816	16,922	6,400	25	66
	145	50 to 100	10,267	7,458	17,725	6,866	47	122
	84	100 to 150	10,034	7,761	17,795	7,483	90	211
	63	150 to 200	10,982	7,147	18,129	7,560	120	287
	76	200 to 300	16,654	10,839	27,493	11,188	147	361
	41	300 to 400	14,247	7,580	21,827	10,914	266	532
	10	400 to 600	4,488	3,506	7,994	3,000	300	769
	1	679	679	661	1,340	450	450	1,340
	1	10,53	1,053	810	1,855	500	500	1,855
Number of Vessels registered in 1838.....	*677	..	74,510	56,578	131,080	54,361	—	—
Not registered.....	83	..	4,154	5,484	9,638	2,129	50	116
Total number in Great Britain and Ireland, 1838	760	..	78,664	62,062	140,718	56,490	—	—
Isles of Guernsey, Jersey and Man, 1837.....	† 6	..	832	618	1,450	600	100	241
British Plantations, 1837	†44	..	8,411	7,253	15,664	6,160	140	350
Grand total	810	..	87,907	69,933	157,840	63,250	—	—

* The Custom-house Return enumerates 678 steam vessels; but the tonnage of one—burnt—is omitted.

† These are extracted from Mr. Porter's Returns, as we have not received them for 1838.

may be expected to increase the number of ocean steam ships, and there is reason to expect a further increase of river and channel steamers. This extensive and rapidly augmenting steam-marine has naturally drawn our attention to the consideration of those means which may assist in rendering it as effective and available for warlike purposes, as it now is for those of peace.

This important branch of the subject has been brought prominently under our notice, and is ably discussed by several highly qualified correspondents. The measures recommended by these gentlemen, as the basis of a system which would, in their opinion, promote the true interests of commercial steam vessel owners; add to the security of the public; put the mercantile steam-marine in a state of greater efficiency; and render it more immediately available, in case of need, as an arm of offence or defence, seem to be free from any material objection, and to provide practical securities against the frequency of accidents. The principal of these measures are—

Firstly. A national system of registration.

Secondly. Periodical surveys of the hull and machinery of all steam-vessels.

Thirdly. The granting or withholding certificates of seaworthiness, and of the right to ply with passengers.

These recommendations demand that we should enter, at some length, into their nature and probable effect, referring, at the same time, to the expressed opinions of our correspondents.

Among the communications contained in the appendix, we beg to direct particular attention to the facts and suggestions stated by Mr. C. W. Williams, in his several papers. This gentleman's observations carry with them the weight of long and extensive experience. The City of Dublin Steam Packet Company, of which he is managing director (as also of the Transatlantic Steam Ship Company), was formed in 1824, chiefly through his exertions and enterprise, when they commenced the trade with one vessel between Liverpool and Dublin; the first vessel ever intended for the conveyance of merchandize across the Irish Channel, and to ply during winter. They have now a fleet of 21 sea-going steamers, amounting to

nearly 9,500 tons gross measurement, propelled by engines of 5,550 aggregate horse-power; they have also several river steam vessels on the Upper and Lower Shannon.

The science and safety of steam navigation owe much to Mr. Williams. He introduced into steamers the division of the vessel into compartments, by *wrought iron, water-tight bulkheads;* his paper on the subject of these bulkheads, in which he also states the trifling comparative cost at which this simple and important means of safety is procured, will be read with much interest, as also the remarks of Messrs. Curling and Young, and of Messrs. Maudslay and Field, on the same subject. They were first applied in the *Garryowen*, in 1834, which was also the first iron *sea-going* steamer, and made to Mr. Williams's order.

Mr. Williams has discussed and contrasted the "inefficiency of voluntary or optional surveys of steam vessels," with the advantages likely to result from a "national system of registration and survey," together with the influence on private and national interests to be expected from the latter. His conclusion is as follows:—"As a mighty means, then, of strengthening our national defence, for the sake of the public, for the better security of the underwriters, and as an encouragement to builders, engineers, and owners of steam ships, an authoritative, sufficient, and compulsory system of registration and survey is, on every ground, desirable.

Mr. Williams has also furnished us with a *specification* for the construction of the hull of a 600 ton steam ship. This is accompanied with an article "on the importance of building steam ships to a detailed specification," and with sketches illustrative of his method of constructing and fastening some of the more important parts; also, observations "on iron vessels." These documents cannot fail to be recognised as highly valuable by all parties interested in the naval architecture and management of steam vessels.

We cite one passage from Mr. Williams's paper on the "specification" alluded to:—

"I have stated that this specification is not presented as perfect, or as an unerring or fixed standard; quite the reverse; it is but the beginning of what, in my estimation, will hereafter become the best guarantee to the public and the owners, and prevent steam-companies from being blindly led into the construction of steam-vessels on faulty principles, or of insufficient strength; and it supplies some standard by which the public may be guided in its choice of *steam-conveyance, rather* than by the *gildings, gothic mouldings, mirrors, paintings, and other attractions lavished on the cabins of the advertised*—'*Splendid and Noble Vessel,*' to the neglect of the manner in which the frame is put together and strengthened, and upon which the safety of the vessel depends. In working out this desirable change, the labours of your commission cannot but be of advantage; as, if they do not at once provide a substantial remedy, they will open the eyes of the owners and the public, and ultimately lead to what is desirable and practicable."

In these practical views he is supported by many correspondents; amongst others, by Messrs. Curling & Young, and Mr. Gibson, eminent ship-builders.

Messrs. Curling and Young observe, "In some vessels materials of inferior description and perishable quality are employed; in others, the connection of the parts is ineffective, the fastening injudicious or scanty, or the workmanship negligent. But defects of timber are concealed by planking; defects of planking, by cabin fittings; and defects of all by painting and decoration, which reduce all to one level of appearance, and by this appearance the public is deceived, and its safety compromised. Of the *splendour of a saloon* and the comfort of a cabin, every passenger is a judge; of the strength of a vessel, the state of repair, or the general adaptation for a voyage, few are able, under any circumstances, to form a competent opinion, and fewer still have opportunity for becoming acquainted with those facts, on which alone a just judgment could be formed."

Mr. Gibson says, "The steam-packet owner looks only to the *splendour of the saloon* and the velocity of the vessel; it is upon these alone that he depends for success, the safety of the passengers is altogether lost sight of; to ensure speed, the fabric of the vessel is made as light and flimsy as possible to hold together."

On the inefficiency of optional surveys of steam-vessels, and on the security which would result from frequent periodical compulsory inspection of hull and machinery by *competent persons, uninterested in the trade of ship-building or engine-making*, all the ship-builders who have favoured us with suggestions for regulations, or other practical measures conducive to safety, are agreed. Many of them give apposite illustrations of their opinions. Messrs. Curling & Young, of London; Messrs. W. & T. Wilson, Mr. Milchrest, and Mr. W. W. Russell, of Liverpool, particularly instance the good effect of the "Passenger ct." The latter gentlemen say, "The 'Passenger Act' (Will. 4, 1835, c. 53,) *compelling* merchant-vessels to undergo survey previous

to being permitted to take out emigrants) has been the means of saving hundreds of lives, by prohibiting vessels not seaworthy, or ill found, from being used for that purpose, which practice had occasioned great disasters. Emigrants have gone out in ships to America which were unsafe to make a trip from Liverpool to the Isle of Man." The protective results of this "Passenger Act" in diminishing the number of shipwrecks, and the consequent loss of life and property, were, also, repeatedly brought under our notice at Glasgow and other ports, as strictly analogous to the effects which may reasonably be anticipated from some similar measure applicable to steam-vessels.

Mr. North and Mr. Gibson, of Hull, and Mr. Duncan, of Greenock, express similar opinions as to the necessity of a compulsory survey, such survey to begin with the construction of the hull, and to be continued in frequency, according to the age of the vessels and machinery.

Similar sentiments are expressed by nearly all the surveyors to Lloyd's Register of British and Foreign Shipping; and both the ship-builders and the latter agree in no inconvenience or delay being occasioned to shipping by *surveys;* as they are rapidly performed, and a time is chosen when the vessels are unemployed. The whole concur in opinion that boilers, engines, and all the machinery should be inspected minutely, and periodically; and that certificates to ply be granted only when a vessel is pronounced seaworthy, and safe, by competent, disinterested inspectors.

We found, during our visit to the outports, that more than one steam-vessel company has announced to the public, by advertisement, that the boilers and machinery of their vessels are "inspected by competent persons every voyage." *In the degree meant to be conveyed*, this is, however, a delusion.

Of parties directly engaged in Steam Navigation, five out of eight owners of vessels, or agents to companies who have answered our queries, coincide in thinking that the safety of the public would be increased by a legalized compulsory inspection; and that their interests and property would be benefited by the measure. Several also have expressed these sentiments to us who have not written them. Two of this class of correspondents are of a different opinion, and think that no better security to the public can exist than that arising out of the well-understood interest of owners and engine-makers, and that no government or local inspection would add to the public safety. *We have to regret that replies* to our inquiries, from steam-vessel owners, have not been more numerous.

From manufacturers of engines and boilers, civil engineers and others versed in these subjects, we have received numerous communications, to some of which reference has already been made in our review of various accidents. It is difficult to classify the opinions of these gentlemen. One or two only of them think that any system of inspection would be intolerable, or practically useless; some ascribe all accidents to the sheer carelessness of those in charge, and detail special instances; most refer to the want of frequency in the repairs of boilers, and to the danger resulting from owners or agents working them too long; nearly all testify to the frequent incapacity of engine-men, and several to the necessity of examining them as to their knowledge and moral conduct, and allowing them to act only under license; some suggest that it would be sufficient, or of advantage, to employ a competent person to investigate the causes of an accident after it has occurred. The subject, as a whole, is elaborately and scientifically treated by several of this class of correspondents, particularly by Messrs. Maudslay & Field, N. Harvey, J. C. Enys, J. S. Russell, J. Oldham, E. Gilbert, John Seaward & Co. and others. These communications will be perused with interest, emanating as they do from a body of practical men engaged in the advancement of engineering science, a large proportion of whom suggest the employment of surveyors both of hull and machinery, as likely to obviate or diminish the occurrence of accidents. Messrs. Maudslay & Field conclude their observations as follows:—

"An occasional inspection, conducted by authorized and well-qualified persons, on liberal principles, so as not to be inquisitorial, or impede improvement, would have the effect of keeping up the attention of companies and owners, as well as of engineers, to the consideration and safety in the constructing, managing, and working of steamers; a subject which, from want of consideration, ignorance, or cupidity, is often overlooked or disregarded."

We have another series of communications from harbour-masters of ports, whose official duties render them intimately conversant with the condition and management of steam-vessels. They represent safety-valves as too generally *accessible*; boilers too often worked till they are in a dangerous state of weakness; coals too commonly stowed in situations liable to occasion their ignition, or that of the vessel; engine-men as frequently intoxicated, or stupified with drink, and given to load their valves in order

to *race* other boats; a frequent deficiency of apparatus to denote the level of the water, pressure of the steam, &c. Much information and many useful practical suggestions will be found in the replies to our queries by Messrs. Askew, Russell, Johnston, and Dall, harbour-masters of Liverpool, Glasgow, and Leith.

The coroners of several ports have readily complied with our request for facts as to the particular accidents which have come under their notice officially. It has already been seen how materially we have benefited by the communications of those gentlemen in aiding us to assign the true causes of the disasters which befel the *Forfarshire*, *Union*, and *Victoria*. These gentlemen, with P. Hodgson, Esq., coroner for Whitehaven, (who is also a steam-vessel owner), and A. B. Bone, Esq., coroner for Devonport, all advocate a system of inspection. They state, that, on inquests, the evidence generally tendered comes from *interested* parties; and that, from the want of power to compel and pay competent persons to inspect a steam-vessel, testimony as to the cause of an accident is generally deficient. Mr. Bone suggests, that as coroners have no power to hold an inquest when bodies are not found, the imperfection of the law might be remedied by empowering *magistrates* to institute an inquiry into the cause of death, and to compel and pay competent persons to investigate it. Mr. Grimson, coroner for Bristol, suggests that every coroner should be authorized, assisted by a jury, to hold a court of inquest, to determine, *à priori*, on the safety or insecurity of steam-vessels and steam-carriages, and to grant licenses to sail or travel.

We have been favoured with valuable answers to our letters and queries, by distinguished naval officers, and experienced commanders of Her Majesty's and mercantile steam-vessels, several of whose communications have already been referred to. We have the advantage of presenting in our Appendix letters from Admirals Sir Philip Durham, G.C.B., and Sir David Mylne, K.C.B.; Captains Chappell, Denham, Colquitt, Michell, Austin, Forder, Smith, R.N.; Lieutenants Crichton, and Lowe, R.N.; William Bain, Esq., R.N,; and from Messrs. Anderson, Allen, and Knight, commanders of mercantile steam-vessels. Many *desiderata* to perfect the equipment and sailing qualities of steamers are pointed out by these gentlemen, particularly a convenient and rapid means of *disengaging the paddle-wheels* from the engines, which, when *per*manently attached to them, offer so great *an obstruction to the progress* of a ship, as to render sails comparatively useless. It has been ascertained that when paddle-wheels are disengaged, steamers under sail have been able to cope in speed, and in facility of manœuvring, with other ships.

The importance of fitting the condenser with a pipe to draw water from the bilge, in the event of a serious leakage, or shipping a sea, &c., is strongly advised, as a powerful means of preventing a common cause of wreck and foundering. Engines require a greater supply of water to condense the steam at each stroke, than could be removed by all the pumps which it is convenient to attach to them; the condenser, therefore, is the most rapid evacuator of water, in case of need. This simple apparatus is now fixed in the best engineered steamers, and cannot be too strongly recommended as an appliance to all.

Heavier and more efficient ground tackling, a better equipment of sails, a larger number and better quality of boats (particularly of life-boats, life-preserving apparatus, signal rockets, &c.) are alluded to by these and many other correspondents as desirable in steamers. An ingenious plan for the stowage of boats forming the cover of paddle-boxes has lately been invented by Capt. George Smith, R.N, with the view of enabling a vessel to carry a larger number of boats without inconvenience.

The necessity of a complete and universally obeyed code of night-signals, and of one fixed "rule of the road," forms also a special subject of their remarks.

The greater security which would result by obliging *masters*, *mates*, and all *engineers* of steamers to pass an examination, like pilots, previous to their obtaining a certificate to act, is also strongly commented upon. On this subject we quote one sentence from Capt. Denham's letter, who advises, "that the master and mate should not only have served in those capacities in sailing-vessels of corresponding tonnage, but go through an examination as to the common working of the engines; for it is a fact, and a frightful one, that in nine cases out of ten, the whole mass of life and property depends on the existence, health, sobriety, or indeed honesty of purpose of *one* man, *the engineer*."

The three principal measures, before adverted to, viz., the *registration*, *survey*, and *licensing* of steam vessels, are advocated by most of these correspondents. The bearing of these measures on the security they would afford to the public, together with the effect expected from them in maintaining the mercantile steam-marine in a condition to be more serviceable, and more quickly available in case of war, is exhibited by several naval

officers possessing great practical experience in the command and management of steam-vessels. Lieutenant Crichton, R.N., an experienced officer, and one of the managers for the London, Leith, Edinburgh, and Glasgow Shipping Company, has entered at some length into this part of the subject. He prefaces some valuable observations, as follows :—"The qualification of *(steam-vessels)* being eligible for employment in the public service, will be considered of more importance hereafter, when the extent of steam force which Great Britain must draw from her mercantile marine, in any future war, becomes properly understood, &c."

The "extent of steam-force," which can be called into action for the defence of the country at the present moment, may be gathered from the table containing a statement of the number, tonnage, and power of steamers above given. Capt. Austin, R.N., has pointed out some of the details which should be registered, in order to aid naval officers in their judgment, and selection of mercantile steamers for national purposes.

Summary of Measures recommended.—Our inquiries have convinced us that great public advantage would result from the adoption of a system of *registry*, *periodical survey*, and *license* of steam-vessels. A national registration would be the statistical record of all details of construction both of hull and machinery ; the subsequent and periodical surveys would ascertain the actual condition of every vessel at stated periods ; and access to these documents would furnish accurate knowledge, of an invaluable nature, to all parties interested in Navigation by Steam. Should the Government have occasion to hire or to purchase steam-vessels for naval, military, or other purposes, these records would enable their officers to select vessels, whose strength, efficiency, capacity, power, &c., would be known ; together with all the minor, yet important details necessary to determine the fitness of a vessel for any special service These records, and their accessibility, would stimulate the owners of steam-vessels to construct, and fasten them on the most approved models ; to supply them with the best machinery ; and to maintain them in the most efficient state of repair and sea-worthiness.

That the science on which Navigation by Steam depends for its economy, safety, its present success, and future advancement, would be promoted by these measures, cannot, we think, admit of a doubt. Persons commercially interested in this branch of our national power and prosperity, whether *ship-builders, engineers, owners*, or *commanders, ardently desire* and seek for results, and correct information, which at present are procured with difficulty, or are still oftener, unattainable. When it is considered that a large and increasing capital is expended on the hull, machinery, and equipments of a single ocean-going, or large coasting steam ship (a transatlantic steamer costing above 50,000*l.*) ; that every deviation from already adopted dimensions, proportions of parts, and power, or methods of constructing the hull and machinery, is an experiment in which not only mercantile success, but the security of life and of property to a vast amount are involved, we think the value of a national, and accessible record of facts, cannot be too highly appreciated.

The importance of keeping a steam-log, on board ocean-going steam-ships especially, is alluded to by several of our nautical, and other correspondents, who also suggest that the contemplated registration system should include a record of such logs.

We have reason to believe that the deposit of these useful documents would not be objected to by steam-ship companies ; the log of the *Great Western* has been printed, and the owners of the *Liverpool* have adopted the same excellent means of registering all engineering facts and occurrences during the transatlantic voyages of that vessel.

The following table has been supplied by Mr. Shaw, with additions by Messrs. Curling and Young, and Messrs. Maudslay and Field, and we believe it to be nearly correct. It contains some of the dimensions of the hull and machinery of the five largest steam-ships yet built or building, which principally influnce their steaming and other requisite qualities. With an exact knowledge of these dimensions, and power, combined with a knowledge of the effect produced, which the logs would supply, the ship-builder and engineer would proceed on surer data ; and proprietors could count, with greater certainty, on a new vessel answering its intended purpose, To the degree in which all these parties have been occasionally disappointed in their expectations, and how costly have been the alterations rendered necessary by mistakes, every large steam-vessel company could bear ample testimony.

The practicability of executing two of the three principal measures recommended, viz., *registration* and *periodical surveys*, is proved on a large scale by similar operations, conducted under the direction of the Committee of Lloyd's Register of British and Foreign Shipping.

The effects of the system pursued by this eminent establishment, on the security to property and life on board sailing vessels,

Dimensions.	Great Western.	Liverpool.	British Queen.	President.	United Kingdom.
Extreme length ..... feet	236	223	275	265	—
Ditto under deck ..... „	212	216	245	238	206
Ditto keel ..... „	205	209 5 in.	225	220	198
Breadth within the paddle-boxes .. „	35 4 in.	30 10 in.	40	41	36 6 in.
Ditto including ditto .. „	59 8 in.	56 3 in.	64	64	—
Depth of hold at midships ..... „	23 2 in.	19 8 in.	27 6 in.	23 6 in.	22
Tons of space ..... „	679½	559½	1,053	—	—
Tonnage of engine-room ..... „	641½	581	963	—	—
Total tonnage ..... tons	1,321	1,140½	2,016	1,840	1,400
Power of engines ..... horses	450	468	500	540	450
Diameter of cylinders ..... inches	73	75	77½	80	73
Length of stroke ..... feet	7	7	7	7½	7
Diameter of paddle-wheels ..... „	28 9 in.	28 5 in.	30 6 in.	31	28
Total weight of engines, boilers and water ..... tons	480	450	500	500	450
Total weight of coals, 20 days' consumption ..... „	600	600	750	750	—
Total weight of cargo ..... „	250	200	500	750	—
Draught of water with the above weight of stores ..... feet	16 8 in.	16 6 in.	16 7 in.	17	—

have been highly advantageous to mercantile interests, and to the safety of ships. It appears, however, that as regards steam vessels, the praiseworthy efforts of the committee are powerless and inoperative. It is stated by various correspondents, ship builders, steam vessel owners, and also by the intelligent surveyors of Lloyd's, that the mass of the proprietary of steamers do not register their vessels; or do so chiefly with the view of advertising a new vessel in the widely circulating volume annually published by that body. It appears, also, that of the steamers registered, many discontinue those periodical surveys required by the rules of the society as necessary to determine their character in the list. That such is the fact, is shown by the circular issued to owners of steam vessels by the committee, dated 6th December, 1838, and by the blanks in the surveys of steam vessels registered in Lloyd's books, a list of which is communicated by Charles Graham, Esq., secretary. The numerous derangements to which steam vessels are liable are, clearly, far beyond the reach of a commercial body, unassisted with the authority of the law, and not possessing that mechanical knowledge which can alone enable it to decide on the merits of a mechanical question submitted to them. Self-interest demands of the owner of sailing vessels that heshould register in Lloyd's books, and conform to their rules. The same principle actuates the steam vessel owner to register a new vessel, but when that vessel is no longer worthy of a character, and when the owner knows he can no longer obtain a good reputation for his vessel at Lloyd's, he discontinues his surveys, which is precisely the time when a compulsory survey is required for the safety of the public.

Human life cannot be secured by underwriters, and passengers form the principal source of revenue to steam vessel owners—to the greater proportion the only source. Lloyd's Register holds out no inducement to this class to adopt its regulations; it appears, also, that on steam vessel cargoes in general, there is no difficulty in effecting insurance at lower rates than by sailing vessels; and the large steam companies are very commonly their own under-writers, insuring only the value of the vessel, and sometimes that of the engines.

A trust-worthy survey and report on the state of the boilers and machinery of steam vessels, upon which so important an act as the granting a certificate, affirming them to be "in good order and safe working condition," should be made, not by the makers of the engines, or by fellow engineers, or by parties who have repaired or who may be called upon to repair them, but by competent persons independent of all interest in their construction, and of all connection with steam vessel owners. Nor do rival engineers like to survey and report upon each other's work.

(To be continued.)

THE "BRITISH QUEEN."

This splendid vessel arrived at Liverpool *on Monday the 1st inst., and in the* Thames, *at Blackwall on Friday, the 5th. She performed the passage from Greenock to* Liverpool in 18 hours, and from Liverpool to London in 67 hours, giving an average of 10 knots an hour. This favourable rate of steaming was performed with, and has been

attributed to, the action of Mr. S. Hall's condensers (from whom, and respecting which, we have received a letter, published in another part of our Magazine). The "Queen" started for New York at nine o'clock on Wednesday morning, and we hope the favourable commencement of her voyaging will be borne out in her first trip to New York. The vessel and her machinery we have already described, we have only to add a few words on the fittings up for the accommodation of the passengers. A spacious saloon or dining room, the length of which is upwards of 60 feet, the width 30 feet, and in the narrowest part 20 feet; height to the ceiling eight feet. The ladies' cabin is about 16 feet square—both are entered right and left by folding doors from a handsome lobby and staircase, having a double flight of stairs with richly carved oak ballusters. The whole forms a suite of 90 feet in length. The saloon is richly and elaborately decorated in the Elizabethan style of ornament. The walls are hung with a newly invented imitation of tapestry, containing brilliant panels of alternately historical painting, and emblematical and ornamental devices, which look like needlework; and from richly carved brackets, which support the beams, are suspended bunches of flowers and fruit made of leather, in imitation of carvings. The ceiling and wood-work are painted to imitate oak, and gilt in parts. The sofas, chairs, &c., are also of oak, and covered with richly cut plush velvet. The carpets are very handsome, and the saloon is warmed and ventilated by a handsome stove on Sylvester's principle. The ladies' cabin is neatly decorated in white and gold in the arabasque style, and contains a library and pianaforte. The whole of this suite was designed and executed by Mr. Simpson, of West Strand, and the workmen and artists were sent expressly from London. The furniture was made at Glasgow.

DOWIE'S PATENT BOOTS AND SHOES.

When the foot is under the pressure of the body, it is elongated. This principle of elongation seems to have been long admitted, inasmuch as all boots and shoes have hitherto been made a little longer than the foot of the wearer; but the difference in the degree of extension in the feet of different individuals appears to have been, in some measure, overlooked, as it rarely happened that allowance was made for this difference; and the result has been, that many persons have never obtained shoes long *enough for their feet, when thus extended,* the measurement being generally taken when the foot is not under the pressure of the body. Another important consideration arises, from the circumstances connected with the altered positions of the foot in walking. As the foot extends in length from heel to toe, in proportion to the height of the arch, the strength of the ligaments, and the weight it has to support, the elongation has been found, by actual measurement, to vary from a quarter of an inch to a whole inch. * * *

Many years ago, I was much impressed with the imperfections in the structure of the boots and shoes in general use. After devoting much time and attention in endeavouring to remedy their defects, I believe that I have at length succeeded in attaining this object. This is effected by making those parts of the boots or shoes immediately under, and on each side of, the principal arch of the foot of an *elastic material.* This material is composed of caoutchouc and animal skin, so manufactured as to bestow on the fabric the elasticity of the caoutchouc, while it retains the tenacity and durability of leather. The introduction of this elastic substance allows considerable changes to be made in the form of the boots and shoes, and gives the wearers the free use of their feet and ankle joints in walking, to a much greater extent than any hitherto in use.—*Trans. Soc. of Arts of Scotland.*

NOTES AND NOTICES.

Natural Exhalation of Carburetted Hydrogen Gas.—In the Vale of Cwmdare, near the village of Aberdare, Glamorganshire, there is a waterfall, which has, latterly, become an object of peculiar interest, in consequence of a phenomenon, hitherto unnoticed, and probably altogether new in character. It consists of an extraordinary exhalation of gas, spontaneously issuing from the bed of the stream, and which, being ignited, continues to burn, without intermission, with a yellow-coloured flame, interspersed with streaks of vivid white, orange, purple, and blue. There are more than twelve apertures through which the gas escapes beneath the water, (causing it to rise and bubble); others on the dry banks, which increase daily in size. One of the apertures is considerably larger than the rest, the flame from which burns about two feet in length, and a foot and a half in width; at times it burns considerably larger. The soil consists chiefly of argillaceous schist, or fire clay, sufficiently hot to burn the hand. Fish caught in the stream have been boiled upon it; and the friends who accompanied me to the spot, prepared a good supper of broiled bacon for ourselves and the spectators. My first impression was, that this phenomenon was occasioned by an escape of carburetted hydrogen from a coal level, but from its distance from a mine, and the occasional appearances in the flame, I do not think the idea can be correct; most probably it is a mixture of gases. The water has been observed to bubble for many years, by the peasantry, but not to any extent, until within the last two months, when the attention of a Staffordshire miner was attracted by the noise and height of the bubbles, and subsequently by the application of a fire. I had an opportunity of witnessing this wonderful appear-

ance by night, and regret my inadequacy to describe a sight so interesting. There were no less than twelve large bodies of brilliant flame, of a great illuminating power, issuing from the bed of the stream, and underneath the rock which forms the waterfall; the rich glare of variegated light cast upon the trees and surrounding objects, the noise of the waterfall of the stream, and the reflection of the whole in the water, afforded one of the most imposing sights I ever beheld. I collected two quart bottles of the gas, and have given them for analysis to my friend Mr. Maugham, of the Gallery of Practical Science, Adelaide-street, who will furnish you with a paper on the results.—*Correspondent of Athenæum.*

Society of Arts for Scotland.—The list of prizes offered by the Society of Arts for Scotland, for 1839-40, has just been issued, and for the information of our readers—some of whom may desire to become competitors—we publish it. The rewards offered, although far below what they should be, effectually to draw out dormant talent, are still respectable, and more worthy of competition than those of the London Society. We have great hopes that, should our esteemed correspondent Mr. Baddeley be successful in obtaining the Secretaryship, he will instil new vigour into the Adelphi members, and spur them on to regain the ground they have lost. I. For the most important invention, discovery, or improvement in the Useful Arts:—The Keith Medal, value 20 sovereigns. II. For the best Essay, to be lodged betwixt and 1st November next, on the most improved manner of laying rails on railways—the most improved form of rails—and the best width of gauge:—The Society's gold medal, value 20 sovereigns. III. The society proposes also to expend the sum of 80 sovereigns, in various pecuniary prizes and honorary medals, in rewarding approved communications on the subjects hereafter mentioned—and likewise on any other inventions or improvements which may be submitted to them—and for essays or detailed accounts of public or other undertakings of great national importance, not previously published. 1. For the best series of experiments applicable to the Useful Arts. 2. For the most important communication of any useful invention, process, or practice from foreign countries, not yet known or adopted in Great Britain. 3. For the best set of experiments on the consumpt of fuel by locomotive steam-engines. 4. For the best series of experiments on the comparative economy, comfort, and safety, as regards health, of stoves for heating apartments. 5. For an account of a new and improved method of ascertaining degrees of temperature too high to be indicated by common thermometers; with a view to enable founders, bakers, and others who employ fire heat, to conduct their respective processes with greater certainty. 6. For the best series of experiments on photographic drawing, particularly as to the preserving and multiplying of the impressions. All communications must be written on foolscap paper, leaving margins at least one inch broad on both the outer and inner sides of the page, so as to allow of their being afterwards bound up with others; and all drawings must be on imperial drawing paper, unless a larger sheet be requisite. The society reserve to themselves the power of determining whether any communication be of sufficient merit to entitle it to the prize for which it competes, and of modifying the amount of the prize. All communications (except those competing for prize II.) to be lodged as soon after 1st November, 1839 as possible, in order to insure their being read during the session; but those which cannot be lodged so early, will be received till 1st March, 1840. Communications, models, &c., to be addressed to James Tod, Esq., the Secretary, at the Museum of the Society of Arts, 63, Hanover-street, Edinburgh.

Ancient and Modern Steam Engine Duty.—In the course of a well-digested lecture on the steam engine, by Mr. Sims, of Chacewater, delivered at the Truro Institution, a comparison was drawn between the engines of Watt's time, and those of the present day. As nearly as the average of the former could be obtained, their duty could not be more than 15,000,000 lbs. lifted a foot high by the consumption of a bushel of coal; while in Messrs. Lean's Report for the last month, the average duty of sixty-one pumping-engines was found to be 54,000,000 lbs. Those sixty-one engines consumed, for a month, 4,283 tons of coal, and lifted 41,000,000 tons of water 100 fathoms high. The same number of engines in Watt's time would, to do the same work, consume 15,418 tons of coal, which at 15s. would be 11,563*l.*; from which, deducting 3,211*l.*, the cost of working at the present day, there would remain 8,352*l.* per month, or upwards of 100,000*l.* a-year saved in fuel on sixty-one engines. The greatest load lifted by any engine now at work in this county was by one in the Consolidated mines, which raised a load of 9,000 lbs. every double stroke it made, and did this nine times a minute, amounting to 567,022 tons lifted 7 ft. 6 in. in twenty-four hours; and this astonishing machine could be started, stopped, or regulated by a little boy.

Phosphorus.—M. Becquerel is of opinion, that electric light renders certain bodies phosphorescent, when they have for some time been exposed to its action. The violet rays possess the greatest degree of this power, while the red rays are entirely destitute of it. Those substances which suffer almost all white rays to pass through them, reduce their phosphorescent property to nearly one half.

Estimate of the average value of the mineral product of Cornwall and Devon annually raised and exported.—If we estimate the value of the metals annually raised in Great Britain and Ireland at about 10,597,000*l.*, and consider that of this sum the iron amounts to 8,000,000*l.*, the value of the remaining metals would be 2,597,000*l.*, of which Cornwall and Devon would furnish about 1,340,000*l.* or more than one-half, leaving 1,257,000*l.* for the value of all the metals, with the exception of iron, raised in other parts of the United Kingdom. The two great metallic products of the district are copper and tin: of the former it yields one-third, and of the latter nine-tenths, of the whole supply of copper and tin furnished by the British Islands and all the countries of the continent of Europe.—*Geological Report*, 1839.

Sir James Anderson's Steam-carriage.—The vessel having Sir James Anderson's steam-carriage on board, sailed from Dublin for London, on Saturday the 29th ult., and is hourly expected in London. It will be put together as soon as possible after its arrival in London, and will be immediately submitted to such trial as the directors of the Steam Carriage Company shall determine upon.—*Mark Lane Express of Monday.*

Engraving on Marble.—Mr. Rayner, of Derby, has made a discovery in art—a new method of engraving on marble. Some of his pictorial efforts have elicited great admiration. Her Majesty is in possession of a variety of specimens, and the nobility in England and France have introduced them into their drawing-rooms.—*Midland Counties Herald.*

Copyright of Designs.—Notice has been given that designs will be received for registration, in pursuance of the Designs Copyright Act, recently passed, at the office of Registry of Design, Wellington-street, North Strand.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 6, Peterborough-court, Fleet-street.*—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

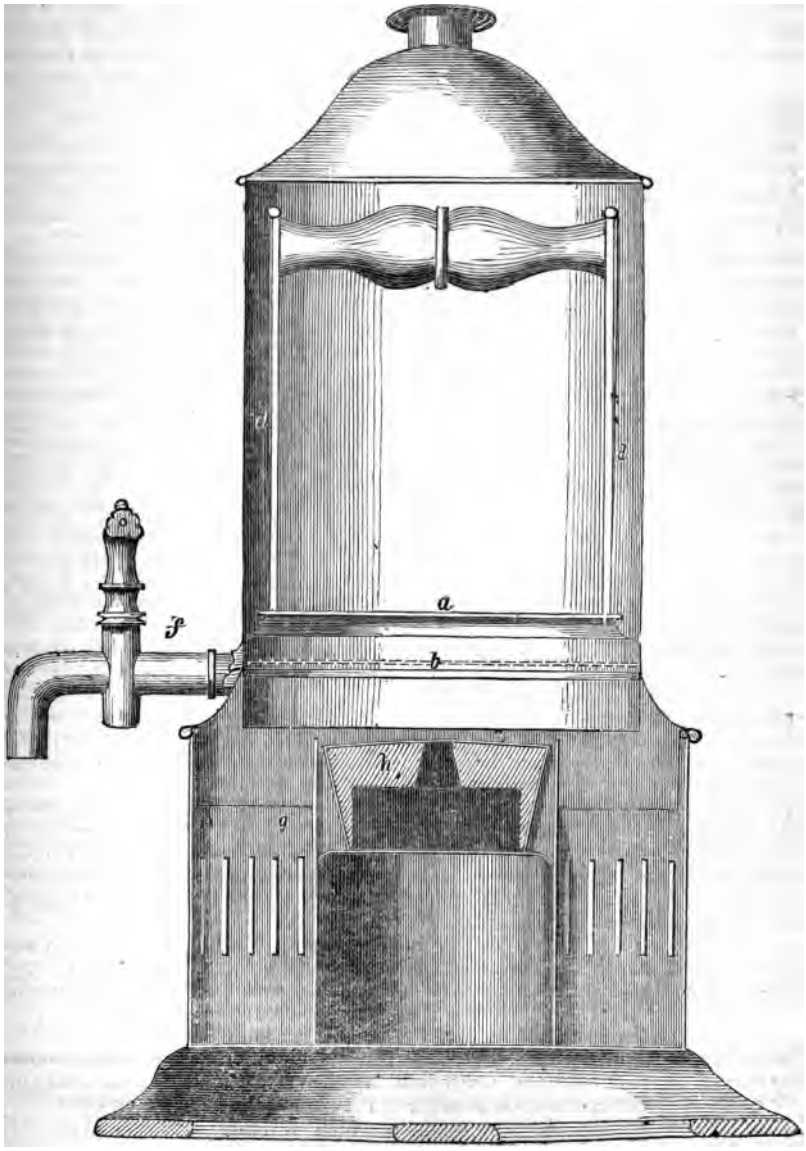
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 832.] SATURDAY, JULY 20, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson No. 6, Peterborough-court, Fleet-street.

BEART'S PATENT COFFEE POT AND FILTERING APPARATUS.

Fig. 4.



BEART'S PATENT COFFEE POT AND FILTERING APPARATUS.

In our 824th number we published a communication from a correspondent who signed himself "Mocha," upon the subject of coffee pots, and particularly referring to Beart's patent and Palmer's non-patent. The remarks of our correspondent were decidedly unfavourable to the invention of the former gentleman. We, in consequence, received a letter from Mr. Beart, in which he says:—

"I shall pass over Mocha's ridiculous remarks as to the labour, &c., of working the coffee pot, leaving that to speak for itself, but I cannot remain silent upon another matter, the priority of the invention over Palmer's. "Mocha" states that he referred to your list of patents: if he did, he was aware that my patent was sealed months before the suggestion of the unknown "scientific friend," was made to Mr. Palmer; and had he examined the specification he would have seen that its application is much more extensive to the purposes of filtration, &c., than Mr. Palmer's, the invention he appears so anxious to forward. If "Mocha" is a sincere lover of the coffee berry, and has philanthropy to wish his brethren of mankind the true enjoyment of this fragrant beverage, he will learn with pleasure that the sale of this patent coffee pot is greater far than I ever anticipated, or than the manufacturers can supply, and though the coffee is generally made by females, no complaint is made of any difficulty in working the same."

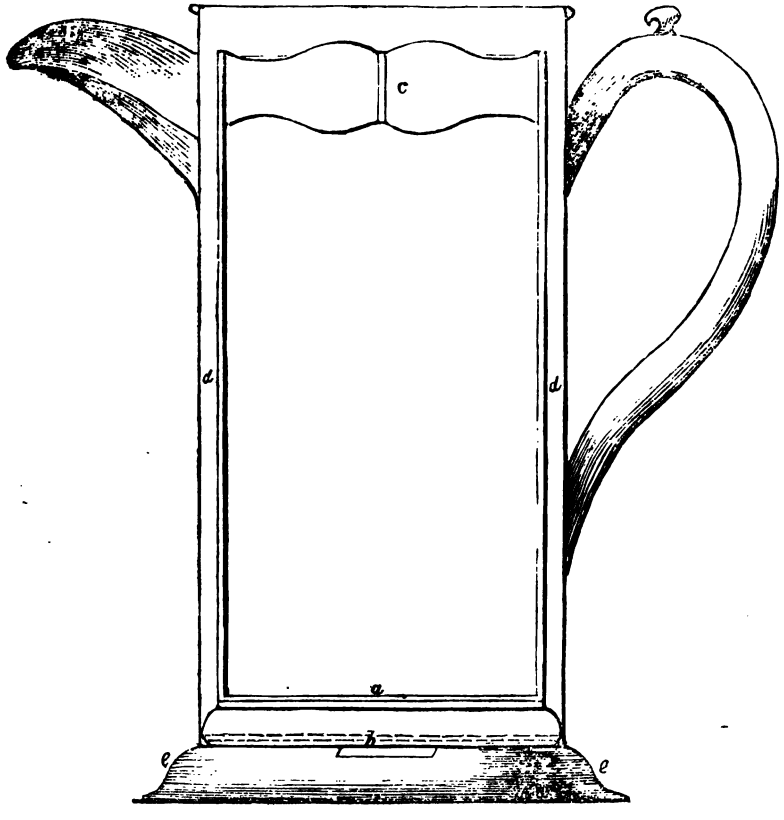
As we always wish to act with the greatest impartiality between inventors, we requested from Mr. Beart a copy of the specification of his patent, which he obligingly furnished us with—and we now publish an abridgment thereof, with the necessary engravings. Our readers will thus be enabled to judge for themselves between the parties. Supposing the inventions to be alike, (and we think that although the action of both depends upon the same principle, the *manner* of action, which constitutes the invention, are very dissimilar), there cannot be a doubt but that Mr. Beart has the precedence. On referring to our register we find that Mr. Beart obtained his patent *on the 6th of November* last, under the *title of "Improvements in* apparatus for *filtering fluids."* Filtering by atmospheric pressure, either through means of producing a vacuum beneath the fluid to be filtered, or by direct force, is by no means a new idea. Its application to clarifying sugar, was, we believe, patented by Mr. Hague, the well-known engineer, some 15 or 20 years ago. A subsequent patent was obtained by a Mr. Tritton (in 1819) for filtering generally; and, as a correspondent, "Sciolisterus," reminds us, a Mr. Field was rewarded by the Society of Arts, some years ago, with the gold Isis medal, for a filtering machine worked by a pump, which he called a "Physeter." While we are upon the subject we may also refer our readers to the French report on filtering by pressure on a very extensive scale, which we published in our last volume, p. 153. Mr. Beart confines his claim of invention to "filtering liquids by means of moveable pistons, having suitable filtering materials applied *thereto.*" So far his invention may be original, and essentially differs from Mr. Palmer's, in which the piston used to produce the vacuum, is in a distinct and separate barrel from that in which the fluid to be filtered is placed. There are coffee drinkers enough in Great Britain amply to pay both Mr. Beart and Mr. Palmer.

Now to describe Mr. Beart's patented plan. He states in his specification, that his "invention relates to a mode of filtering liquids by means of a piston having suitable filtering materials applied thereto, whereby the piston in its upward movement produces a vacuum, or partial vacuum, and the pressure of the atmosphere will cause the liquid to be forced through the filtering material; particularly applicable to the making of decoctions of coffee, and of other matters, and of straining or filtering various fluids for culinary and other purposes."

Description of the Figures.—Figure 1 (opposite) represents a vessel for making decoctions of coffee, or of other matters. Figures 2 and 3 (page 276) are views of a piston shown separately; *a*, is a piston consisting of a ring of metal having a groove round its periphery to receive suitable packing, in order to its moving closely within the vessel to which it is applied; *b*, is the filtering material which may be jean, or closely woven cotton, or woollen fabric which is stretched over the piston, the edge or external line of which filtering material, being turned

over, leaving an end remaining to form packing to enter the groove formed around the piston; *c*, is a handle applied to the two rods, *dd*, which are affixed to the piston, and by which the piston may be raised; *ee*, is a projecting rim affixed to

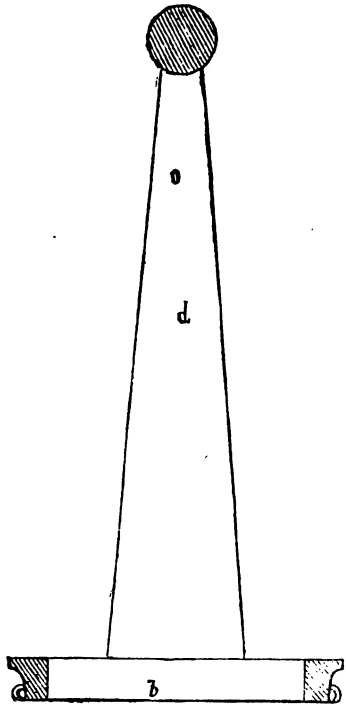
Fig. 1.



the bottom of the vessel, that the person using the apparatus may place his feet on when raising the piston with his hand; or the piston may be raised by rack and pinion, or other convenient means. Supposing it to be desired to make coffee by this apparatus, a small quantity of water is to be put into the vessel to fill up the space to which the piston does not descend, the piston is then to be put into the vessel and forced down as far as it will go; and in all vessels which are to be put to the fire during the time the piston is in the vessel, there should be *stops to prevent the piston going to the bottom, in order that* there may be at all times a small quantity of fluid between the bottom and the piston, to prevent the heat injuring the piston. The requisite quantity of ground coffee is to be put into the vessel, and a quantity of boiling water is to be poured thereon, and allowed to stand for a short time, the piston is then to be raised out of the vessel, by which means the liquor will be filtered and very clear, or in place of filtering immediately, the liquor may be boiled in the vessel, and then filtered by raising the piston; or the coffee may be made in a separate vessel, and poured into the one containing the piston, for the purpose of filtering the same. Thus

it will be seen that the piston is at once the means of producing a vacuum, or

Fig. 2.



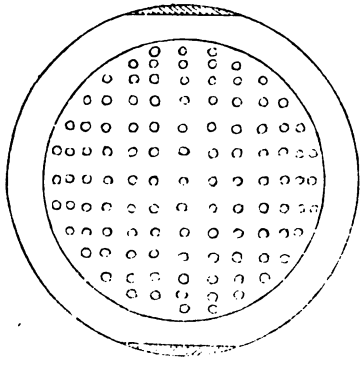


Fig. 3.

partial vacuum, and of filtering the liquid *ubmitted to it, aided by the* pressure of *e atmosphere.*

In place of drawing up the piston, the piston may be forced from the top downwards, by which the grounds of coffee, or other matter will be precipitated and the liquid above the filter will be clear and well filtered.

Figure 4 (front page) shows a section of an apparatus for filtering coffee, in which there is a piston or filtering surface similar to that above described, placed very near the bottom of the vessel, leaving only a small space between the bottom of the vessel and the under surface of the filtering material; *f* is a cock or tap for drawing off the coffee when required. The piston in this case may have a handle to quicken the process of filtration by raising the piston, but this is not absolutely necessary so long as the parts are arranged properly for readily withdrawing the piston and filtering material for the purpose of cleansing. *g* is a frame or stand for the coffee pot or urn, which contains an iron heater, *h*, by which the coffee may be kept heated. In using this construction of coffee pot or coffee urn, the lower part of the pot is to be filled with boiling water; the filtering surface or piston lowered to its place, the proper quantity of ground coffee put into the vessel, and the requisite quantity of boiling water filled in. The coffee pot, or urn, is then placed on its stand, and the same is allowed to stand for a few minutes, when the coffee may be drawn off by the cock or tap, and as the coffee is drawn off, the pressure above will force the liquor through the filtering material.

In making the pistons on the upper surface, there should be a perforated plate or plates of tin or other metals, and the cotton, or other material acting as the filtering material should be stretched over it.

Mr. Beart concludes, by expressly disclaiming filters in which a separate pump or syringe is used to produce the vacuum.

ON THE GENERATION OF STEAM—AND MR. PERKINS'S EXPERIMENTS.

Sir,—I have attentively, and with much pleasure, read the communication to the *Franklin Journal* by Mr. Perkins, transcribed from that work to your pages,

as it furnishes valuable practical information and theoretical opinions, emanating from a well experienced and known authority upon the subject of steam operations. The purport of such communication appears to have been prompted by a desire to controvert the correctness of the conclusions arrived at by the members of the Franklin Institute engaged in the several experiments undertaken with a view to ascertain the cause of steam boiler explosions, etc., and to prevent the injurious consequences which he conceives the promulgation of their opinions are calculated to effect; and he states that the most dangerous of those conclusions is, "that all the destructive explosions of steam boilers have been caused by the direct pressure of the steam."

In this view of the subject I perfectly coincide with Mr. Perkins, and agree with him in opinion as to the repellant power of heat being the cause of the detachment of the water and steam from the sides of boilers intensely heated, if such is his opinion; but of this I have a doubt, as he refers to the repulsion existing between particles of intensely heated iron and water; from which mode of expression I feel at a loss to infer, whether he imagines that the particles of which iron is composed have acquired a property by intense ignition that enables them to repel water from their vicinity, or whether he means to convey the opinion that the atoms of heat radiating from the boiler, repel both the water and steam from its surface; and in the case of the experiments he refers to, prevented the escape of both water and steam from the open cock inserted into the intensely heated tube. As such experiment furnished analogous results to those experienced from the insertion of water in the intensely heated crucible as detailed by Mr. Tomlinson and Dr. Schafhaeutl and induced by the same cause; and as my opinion on such cause and effect has been already recorded in pages 73 and 390 of your 30th vol., it would be superfluous for me again to enter at large upon an exposition of such opinion; but as some readers of the present paper may probably not have seen those communications, or may not have the convenient means of referring to them, I may perhaps be allowed briefly to recapitulate, those opinions as to the cause of the repulsion of the water and steam from the bottom and sides of the crucible, and in Mr. Perkins's experiments from the bottom and sides of the tube, such repulsive power being superior to the power of gravity to which water is subject, and by the force of which power it is naturally held in close contact with the bottom and sides of the containing vessel. In the theory referred to, I endeavoured to inculcate the idea, that water is composed of the class of ponderable and one class of imponderable atoms, the two former denominated oxygen and hydrogen, and the latter caloric. That such atoms are spherical, and the ponderable atoms of greater magnitude than the imponderable. That the position of the imponderable atoms in a state of admixture with the ponderable, are the occupancy of the interstices presented by the approximate union of the ponderable atoms at the lowest temperature of fluidity. That the addition of caloric to water in a state of fluidity, necessarily causes its expansion or increase in bulk, inasmuch as it is the addition of solid atoms to those which are solid, and for which addition there is no room or place previously unoccupied, and therefore the admixture must cause an increase in the bulk or space of occupation of the aggregate amount.

That such increase in the bulk or space of occupation of water by the impartation of caloric, is only limited by the superior specific gravity of water to the superincumbent atmosphere or other medium, and that when the upper stratum or surface of water is rendered specifically lighter than the superincumbent atmosphere, a diminution in its bulk occurs, to the amount of ponderable atoms which may have evolved from that surface, in combination with a certain amount of the imponderable atoms of caloric, and which united atoms constitute the fluid termed steam or aqueous vapour. That the metallic vessel used for the purpose of generating steam or aqueous vapour therein, consists of an assemblage of ponderable spherical atoms united together by attraction of cohesion, with the interstices presented by such union, occupied by a definite amount of latent and indefinite amount of thermometric caloric, and capable to receive a very large amount up to the point of plenitude, beyond which point, any fur-

ther impartation will produce fusion or liquefaction. That the ponderable atoms of the water in contact with such metallic boiler, are larger than the interstices presented by the spherical atoms of which such metal is composed, and therefore cannot pass through to the surrounding medium, but the atoms of caloric being smaller than those interstices, can, and does pass through those interstices from the surrounding medium to the water, and that the impelling power which causes the transition is equal diffusion, to which fixed and invariable law caloric is subject. That caloric is also subject to the secondary law of recession from the centre of the earth or gravitation towards the centre of the sun (or to coin a word, perhaps more suitable—levitation towards the centre of the sun,) and therefore in the process of generating steam, caloric is transferred from the burning fuel to the water in the boiler by the primary law of equal diffusion, and ascends to the upper surface as induced by the secondary law of recession.

That the upper surface of the water will attain to the temperature of evaporation long before the lower or intermediate portion or strata, and steam will be generated upon the upper surface at a temperature of 212° before the body of the water has attained to such an amount. That if the boiler is not filled with water, the space left filled with atmospheric air, will soon be filled with incompressible (yet condensable) steam, the steam expelling the air by the safety valve, or eduction pipe if open. That if then the safety valve is immoveably fastened down, and the eduction pipe closed, and the impartation of heat is continued, the boiler may burst if composed of weak materials, before the water within may have attained to the temperature of 212°; but if of strong materials, the period of impartation previous to the act of bursting will be proportionate to the amount of heat imparted, and the strength of the materials of which the boiler is composed. That no expansion of water can occur by the impartation of heat, beyond the limits attained to, when the whole bulk is of a temperature of 212°. That when a boiler is filled *with water and steam conjunctively* and *separately, that no more* heat can be *added to the interior of the boiler*, than which may be equal to the amount abstracted, and if none is abstracted then none can be imparted. That if a boiler is completely filled with water and rendered impervious both to water and steam, that the continued impartation of heat thereto must necessarily burst it, and in a period of time proportionate to the amount of heat imparted and the strength of the boiler. That all the heat imparted (if perfectly full of water) would be received by and retained in the material composing the boiler (except such as might be abstracted by the external medium by which the boiler was surrounded) and none of the heat imparted would enter the water within the boiler, unless an expansion of the boiler occurred, when the impartation of heat to the water in the boiler, would be equal to the amount of expansion of the boiler. That the heat imparted to the material composing the boiler would operate as a repulsive power to separate its component atoms, as an antagonist to the power of attraction of cohesion and aggregation. That the heat received by such material would be subject to a tendency to transition therefrom both to the external surrounding medium and to the water within the boiler. That such tendency would be induced by the law of equal diffusion. That the operative force of such law both upon the external medium and the internal water would be proportionate to the difference in the thermometric temperature and receptive capacity for caloric of each. That the water under such circumstances being incapable of receiving any heat, or having received to the full amount of its receptive capacity, the whole of the impulsive force exercised by the heat received by the boiler upon the water within it, acts as a reactive force to an equal amount upon the material composing the boiler, and thus such material acted upon by a force repelling its component atoms both from the water and each other, needs nothing more than the impartation of a sufficient amount of caloric, which causes the action of such force, to overpower the attraction of cohesion and aggregation which held them united, to effect the disruption of the boiler.

If this theory be correct, it cannot then be a matter of surprise that the wrought iron mercury bottle, closely stopped and

filled with water, used by the Committee of the Franklin Institute for the purpose of repeating the experiment of Mr. Perkins, should burst previous to the period when they anticipated there would be a necessity for withdrawing a plug, and which no doubt would have burst long before, had it not have been for the partial relief furnished to the bottle by the escape of steam; and well it was that the incautious experimenter who endeavoured to prevent such escape, did not pay for his temerity, and the want of a proper knowledge of the subject, with his life. And if the bottle had not have burst previous to the withdrawal of the plug, it does not appear to me probable that the same result would have ensued as from the experiment made by Mr. Perkins, because of this important difference in the circumstances of the case, that the tube of Mr. Perkins was not filled with water, and the bottle of the Committee was; in the former case there was plenty of space for the water and steam to recede from every portion of the tube, when impelled by the repellant power of heat from its surface, and therefore both remained suspended during the continued impartation, without the power of egress from the opened cock, because the impulsive power of heat pressing on the column of water and steam, was superior to the power of gravity that such water and steam possessed, as would, under ordinary circumstances, have caused it to rush out from the cock. But, in the latter case, the bottle being filled with water, there was no space to admit of its recession from the surface, and although the temperature of the bottle might have been raised to the same amount as that of the tube, yet if the plug had been withdrawn previous to the escape of any steam, whereby such a space might have been formed so as to have admitted of such a recession, the water would, I think, have rushed from the orifice, being not only impelled by its own gravity, but also by the repellant power of heat with which the bottle was invested, and from the ability of the water to receive the treasured heat from the bottle as rapidly as the space was created for its expansion by the withdrawal of the plug. I do not conceive that water can be raised in thermometric temperature to a greater *amount than 212°, or thereabout, according to the density of* the atmosphere, while the product—steam, resulting from the acquirement of such a temperature, is subject to the pressure and reception of the atmosphere; and having ever been taught that the generation of steam can be effected at a much lower temperature in a vacuum, than when the fluid producing it is subject to the pressure of the atmosphere, it does not appear to me to be possible that steam confined in a very strong boiler, with the valves very heavily weighted, or water confined in a very strong boiler or generator, from which no steam can escape, that either such steam or water can ever be raised in temperature above 212°, and, in fact, under such circumstances, I should very much doubt the possibility of raising either to that temperature, while confined within such boiler or generator.

But yet I would not have it understood that I either question the veracity of Mr. Perkins's assertion that the temperature of the steam in his generator heated to 3000°, was 300°, as relates to his belief of such being the fact, or the evidence furnished to his mind of such being the fact, as furnished by the medium by which he ascertained it, any more than I doubt the veracity of the Committee of the Franklin Institute, or the evidences that induced their conclusion "that all the destructive explosions of steam boilers have been caused by the direct pressure of the steam." "But things are not always as they seem to be," and as I question the correctness of Mr. Perkins's conclusion, in the same spirit, I trust, as he questions that of the Committee, he will, I hope, excuse the doubt, for I can well and satisfactorily imagine that a thermometer placed in the steam within a generator heated up to 3000° and insulated from its interior surface, may indicate such steam to be at a temperature of 300°, when at the same time the actual temperature of that steam may not exceed, and probably not amount to, 212°. But to pursue this subject further in the present instance, would be an intrusion on your pages, and the time and patience of your readers, and therefore reserving a resumption of the subject to a future opportunity should circumstances require it.

I am, Sir, yours respectfully,

G. A. WIGNEY.

Brighton, July 8, 1839.

STEAM CARRIAGES ON COMMON ROADS —EVIDENCE GIVEN BEFORE THE PARLIAMENTARY COMMITTEE ON TURNPIKE TRUSTS.

Sir,—Having lately obtained a copy of the Evidence, and Parliamentary Report on Turnpike Trusts, printed by order of the House of Commons last month, I beg, with your permission, to offer a few remarks on the subject.

The whole evidence of Clerks of Trusts, and others connected therewith, goes to prove what might have been reasonably anticipated, namely, that tolls are and will be diminished in consequence of the rivalry of railways. But there is another subject in this inquiry, which most particularly and individually concerns myself, namely, steam locomotion on common roads.

I had never even heard of the Committee's sitting, and if I had, should scarcely have expected that evidence would have been again sought for upon the subject of steam locomotion on common roads. Probably there was a little contrivance to bring this about, as it will be seen that it afforded an opportunity for some of the parties examined to turn it to their own account. The evidence of the first witness touching this subject (steam locomotion) being merely speculative, I pass it by, and come to that of Colonel Maceroni, in which he institutes a comparison between his own boiler and mine, with the not very liberal view of advancing his own interests at my expense.

First, a word or two as to tubular boilers. I can refer your readers to my narrative,* in proof that I had, years ago, used a boiler composed of tubes or cylinders 4½ inches diameter; but finding that I could not keep water in them at all times, their effect varying with the intensity of the fire, and this whether they were placed in a vertical or a horizontal position, I abandoned this form of boiler, and after making several others of different forms and arrangements, I invented my flat chambered boiler, which, up to this time, I have always found to answer every purpose I could desire.

I wish to be distinctly understood as disclaiming any merit as to the first use of tubes or cylinders in constructing a boiler, such being, as a general principle, very old, as may be seen on reference to Stuart's History of the Steam Engine, where it is shown that both Blakey and Woolfe used tubes in their boilers. I only tried different arrangements of them; but whatever that arrangement might be, I invariably found that they would not steadily retain their water, but always ejected a great deal of water with the steam, and hence the use of a separator was indispensable; whilst with my flat-sided chambers, I produce a steady and copious supply of pure dry steam, without the intervention of a separator.

This failure of tubes in generating steam is acknowledged by all I have ever spoken to who have used them.

A scientific French gentleman, desirous of the introduction of steam carriages into France, and who had witnessed the performances of Colonel Maceroni's carriage in Paris, but which he was not at all satisfied with, came to London expressly for the purpose of inquiring into the merits of my carriages, and was one of the party who went by the "Automaton" on the 22d of last month from Kennington to Croydon and back, at 12 to 15 miles an hour, when he expressed his perfect satisfaction of its working.

Tubular boilers, for the reasons before mentioned, get rapidly and seriously out of repair over the *centre of the fire*. What Colonel M. has done to remedy this defect he does not tell us.

I am not aware of the distinction of the terms *tube* and *cylinder*,* any further than a cylinder may be either solid or hollow, whilst a tube can only be the latter. Therefore, from not knowing what respective diameters limit the appellations, I, in my narrative before alluded to, have called these vessels of 4½ inches diameter "tubes or pipes," and where I had one tube or pipe within another for the purpose of increasing the heating surface, I have called the inner tube a "flue."

My boiler (patented in 1827) is composed of a number of thin flat chambers, each of the whole length of the fireplace, placed vertically side by side, with sufficient space between for the action of

* Narrative of twelve years' experiments (1824—1836) *with steam locomotion on common roads, by Walter Hancock. Published by John Weale, Architectural Library, High Holborn, 1838.*

* In his answer to question 301, the Colonel calls one inch bore a cylinder.

the fire upon the thin sides; but as very indistinct and imperfect accounts of my boiler have been given to the public at various times (instance the plate of *Gordon's Journal*, November 1832,) I beg to distinctly remark that all these chambers communicate very copiously with each other throughout the whole series, near the bottoms for water, and near the tops for steam.

Passing over the prefatory* matter of the Colonel's previous occupations, &c., &c., we come to the comparison of my boiler with his, which I propose to examine; but as space in your Magazine will not permit a full transcript from the Report, I will only make a few extracts in the precise words of his replies, where they immediately bear upon the case in question.

His boiler is (question 300) "divided in above 100 cylinders of not less than four inches in diameter, and which are placed in an upright position, and which are not more than *two-thirds* full, so that there is a free surface of water, like a tumbler *half* full, for the steam to escape. When tubes are immersed in the fire, the water is driven out with the steam, and whatever power of steam they may generate, they become inevitably, at some period or other, red hot. (Again 301.)

"Question 307. Assuming that yours, with a given quantity of fuel, gave a power, say 20, how many would Hancock's give?—It would undoubtedly give, I should think, in the proportion of 6 or 7. You see, Mr. Hancock's is about 5 feet cube; between 5 and 6 feet; that is, in every direction; and Mr. Hancock's boiler is not more than of 10 horse power; and Mr. Hancock's, according to his own account, consumes four pennyworth of coke per mile, according to his own statement. I believe it to be true; he is an honourable and honest man; I do not dispute it. My boiler is under 4 feet cube, within an inch or an inch and a half; the one I had to the carriage.

"Question 308. What power is that?—Thirty horse power, with two pennyworth of fuel per mile, instead of four pennyworth.

"Question 309. Yours has half the quantity of fuel? Yes, and very nearly three times the power.

"Mr. Hancock's is nearly double the weight of mine. The size has a great deal to do with it. It looks awkward on the carriage.

"I can generate, certainly, five times the quantity of steam of any other boiler in the world."

From the firm tone with which the Colonel appears to have given his replies to the different questions, I could almost bring myself to believe that he considered he was advancing nothing but known facts; but until I see it, I must more than doubt that a certain and constant supply of dry steam can be obtained from 4-inch tubes or cylinders, as they have ever yet been applied; and I totally deny that, let the cylinders be placed how they may, an equal surface to my boiler can be obtained in equal cubical spaces. If the numbers used in comparison of power or surface (which is the same thing, as he admits,) were reversed, we might get nearer to the truth. I can by no means admit the economy of fuel which he names, any more than I can that his boiler will generate "five times more steam than any boiler in the world."

Let us put his assertions relative to the two boilers to the test of figures; they will not deceive us. He states his boiler to consist of upwards of 100 cylinders, not less than 4 inches diameter. Suppose we take just 100, and those of 4 inches diameter; place them in any direction, either in straight rows or diagonally, and allow the least possible space for flue-way, they will occupy an area of 2500 superficial inches (=50×50.) I on the same area should get in exactly 48 chambers, each 50 inches long. We will take the same height for either boiler; his tubes 3 feet high, my chambers 3 feet high. 100 cylinders 4½ inches (external) diameter, and 3 feet high, the surface is = 354 feet; my 48 chambers =1206. Taking the Colonel's own data, we arrive, by "simple arithmetic," to the indisputable conclusion, that Hancock's surface is 1206 feet, Maceroni's 354; and these 48 chambers, let it be remembered, would form a boiler of six times greater power than the boiler of my powerful steam carriage, "Automaton," which frequently takes 30 passengers long distances, at 14 to 16 miles an hour.

I may here fairly ask, whose carriage will "look awkward," from the large

* The name of Mr. Squires, the Colonel's coadjutor, is *not entirely* omitted. It is introduced in these few short words:—"On my return I was requested by a man of the name of Squires, who had been my carpenter, and who had seen a good deal of *Mr. Gurney's work, to look at* a little carriage he *had built.*"

dimensions of its boiler? who will carry the double weight, &c.?

When Colonel M. says his boiler is only half the weight of mine, I may inquire how he got at the weight of my boiler?

Many of the Colonel's answers in the Report are calculated to prejudice the cause of steam locomotion on common roads; instance where speed is under consideration:—

"Question 333. The expense is increased by the speed?—We have got the steam; therefore we have only got to let it on.

"Question 334. Surely there must be a greater wear and tear of the machinery?—Not in the least."

Now, the following extract from the "Minutes of Evidence of the Select Committee on Railway Communication, in 1837," is very clear on this point:—

"Question 306. The locomotive power has cost the Liverpool and Manchester Company 2*s*. 1½*d*. per mile, but by the last half-yearly report 2*s*. 4½*d*., which is accounted for by the increased speed.

"Question 314. It is the opinion of engineers that the expense of locomotive power is increased by the square of the velocity; that the most economical speed is about 10 or 12 miles an hour, and that any increase beyond that adds materially to the expense.

"Question 317. Performed in so short a time as 1 hour 5 minutes (that is, from Manchester to Liverpool); the fixed time now is 1 hour 20 minutes, altered lately in consequence of the increased expense. The expense of 22,154*l*. for last half year was upon the smallest receipts, 105,000*l*.; whilst in the previous half year's (average of five) they were 125,000*l*., and the expense of power was only 20,500*l*."

I merely quote the above document to show that the member of the Committee who examined the Colonel, was, of course, right, and we cannot suppose that any one believed that high speed and low speed produce the like results in wear and tear. No doubt they would consider the analogy that exists in this respect between animal and mechanical power: drive a horse at constant high speed, he is the sooner done for; drive an engine at high speed, it is the sooner worn out.

The Directors of the Liverpool and Manchester Railway having satisfied themselves of the amount of difference in expense of repairs, immediately fell back upon their old and comparatively low speed.

Now we come to the evidence of the engineer to the "Maceroni Steam Carriage Company"—Alexander Gordon, Esq.

"He (Mr. G.) has travelled 3500 miles by different steam carriages, and has during fourteen years seen every attempt at locomotion on turnpike roads, and has watched with *very great interest* what Colonel Maceroni has been doing."—(Reply to question 368.) "I really think he has got one of the very best boilers which has ever yet been *attempted*."—(Question 369.) "I have no interest in any locomotive carriage of any sort; I have merely taken it up as a very interesting subject."—(Question 393.)

All I complain of in the evidence of this gentleman is his want of candour. When he states that he has travelled so many miles by steam, he does not mention that a certain considerable portion of it has been on my carriages. He has stated his trips to Brighton. As he could not say that he had been there on Colonel M.'s carriage, I think a fair-dealing man would have said he had gone on mine. If he had been pleased also to tell the honourable committee that his name stood on the prospectus of the contemplated "Maceroni Steam Carriage Company," it is possible it might not have affected in their estimation his high praises of the Colonel's boiler, and the sole mention of his performances; particularly as he had previously said—(see Question 393, Report)—"I have no interest in any locomotive carriage of any sort."!

Mr. Gordon once published a few numbers of a periodical, called the "Journal of Elemental Locomotion," and in No. 2, November 1832, he gives a detailed account of his journey to Brighton with me by the "Infant." He says—

"The heavy roads have brought this comparatively fragile machine to a test so severe, that the most sceptical can hardly fail of arriving at the obvious conviction, that if the 'Infant' has proved itself almost equal to the task, *maturity* cannot fail to perform it with ease and regularity."

The manly, straightforward way in which Mr. Ogle gives his evidence in respect to myself, contrasts broadly with the foregoing, and is highly creditable to a high-minded competitor:—

"Mr. Hancock, for want of support, was obliged to withdraw his carriages from the most difficult road for a locomotive carriage in England—the New Road from the Bank to Paddington."

I entered upon that road and continued running daily on it for three months, solely with a view to demonstrate the practicability of so doing in the teeth of high authority to the contrary.

One of the most important questions "affecting the interests of Turnpike Trusts, and the creditors of such trusts," was put to Mr. Ogle, and his answer is worth three-fourths of the evidence given in respect to this part of the inquiry.

"Question 556. Could you point out anything that could be done or recommended by this Committee which would be likely to lead, by any encouragement which can be given, to establishing locomotive carriages upon the common roads?—I think if a sum of 20,000*l.* were placed at the disposal of a committee, with directions to take eight carriages by four different individuals, and place them upon any great line of road, it would at once settle the question, and which money might be afterwards repaid, and a company formed for continuing the operations upon those roads."

We often hear this very inconsiderate question asked—Why do not those who have invented steam carriages that answer so well bring them on the road themselves? As far as regards myself I would say, if I could be repaid the large sum I have expended in perfecting my carriages, I would do so; inventors, however, and builders of carriages are not exactly the class of persons whose previous habits and occupations fit them for such undertakings. *I have a carriage always ready to satisfy any parties disposed to enter upon this business, and am quite willing to enter into such arrangements that shall evince to such parties my perfect conviction of the certainty of success,* and this is all, I think, that can be reasonably expected from me. A few individuals, say four or five, after examining the estimates, and testing the carriage by performances on any road they please, may, by advancing two or three thousand pounds a-piece, lay the foundation for a most extensive and profitable business, and, I think, it must be allowed, that it is worth the while of those who have property in the towns and neighbourhoods of the ancient roads of the kingdom, to consider the matter, and subscribe to an efficient trial. I do not say of my carriages only—if I had no other motive, I have sufficient confidence in my own, not to shrink from a fair trial with any rival whatever—but I think there is room for us all—only *I am now ready*, and therefore no delay whatever need take place as to any sufficient trial to satisfy parties really in earnest to begin.

In conclusion, I think I may be permitted to ask a question in respect to these Committees,—Is it fair to allow any person in any trade to give evidence in his own behalf and against his competitors, without affording the attacked competitors an opportunity of answering for themselves, particularly when it is known that such evidence will, in some shape or other, come before the public? Let parties, however, have recourse to what expedients they please, if steam carriages are brought on the common roads—deeds and not words must test them—in the latter I have little skill, for the former none are more ardently desirous than, Sir,

Your obedient servant,

WALTER HANCOCK.

Stratford, July, 1839.

REPORT OF CAPTAIN PRINGLE, R. E., AND JOSIAH PARKES, ESQ., C. E., ON THE CAUSES AND MEANS OF PREVENTION OF STEAM-BOAT ACCIDENTS.

(Concluded from page 270).

Outline of proposed Legislative Regulations.—Having thus noticed those heads of the subject which appeared to require particular consideration, we now proceed to submit the outline of Legislative Regulations, which we recommend for adoption.

1. That a Board be appointed, in connection with and under the President of the Board of Trade, whose business it shall be to register, and classify all vessels navigated by steam, built, or building; the register to record detailed specifications of hull, and machinery—periodical surveys to be made upon them—and particulars of all disasters, and accidents, which happen to, or may be occasioned by steam-vessels.

That the Board be authorized to appoint Local or District Surveyors, to inspect and report upon the condition of steamers; that, on such report being satisfactory, the Board shall grant licenses to the owners of steam-vessels to ply; that, if unsatisfactory, they shall withhold such license, as far as relates to the conveyance of passengers. Penalty for plying without license.

That the Board be empowered to investigate, personally, or otherwise, the nature and causes of accidents; to examine witnesses on oath; and call for the production of papers.

That the Board be required to make an annual report to Parliament of its proceedings; of the state and progress of the mercantile steam marine; and of the disasters which may have been sustained.

That the records be public, on the payment of a reasonable fee.

That the Board be empowered to frame and issue general instructions for the guidance of the local or district surveyors; also to publish an abstract of the law and regulations, with authority to require such abstract to be placed in a conspicuous part of the vessel; under penalties on neglect.

That the Surveyors of hull and machinery be paid for their surveys by the owners of the vessels, according to a fixed scale, as is the practice for Lloyd's Register; that they shall forward their reports to the Board, which, in the event of the owner or owners objecting to the repairs required, in order to entitle the vessel to a passenger license, shall (if the objection regard the hull) call in one or two of the principal ship-builders of the port or district, unconnected with the work of such repairs, to survey the vessel, in conjunction with the official surveyor, and report specially thereon.

Should the decision of the Board be objected to, on the report of the surveyor (if the objection regard the machinery), it shall call in the aid of one or more engineers to survey and report in conjunction with such official surveyor.

Special surveys to be paid for by the owner or owners of the vessel, according to a fixed scale.

The first survey of the hull of a new vessel, to be made during its construction; and a specification of it transmitted to the Board, as is now done by the surveyors of Lloyd's to the Committee.

A survey of the hull to be made during each of the first two years, and a survey every six months subsequently. All steamers to be docked, beached, or laid on the *gridiron (as circumstances permit)*, and *surveyed, after sustaining any injury by taking the ground, or otherwise*, under *penalty.*

The first survey of the boilers, engines, and machinery to be made whilst they are being fixed in the vessel, and the requisite details of them to be reported to the Board.

Boilers, engines, and machinery to be surveyed every six months after the first year; and all serious accidents to be reported.

The surveyors to report on the fitness of a vessel, whether as a *sea-going* or *river*-steamer.

3. Licence to express whether it be granted for cargo only; for towing-vessels; for the conveyance of passengers; or for these purposes combined; also, whether the vessel be intended to ply as a river, or sea-going steamer.

License to ply with passengers to be granted, or withheld, as aforesaid; a duplicate of which, or certificate to the same effect, signed by the Board, to be exhibited in the cabin or other conspicuous part of the vessel. All public advertisements of steamers to state whether licensed to carry passengers, or not.

An annual charge for each license to be made on all steam vessels, varying according to a scale of size and capacity; such charge to be in no case less than 1*l.*, nor exceeding 5*l.*

4. That the surveyor shall ascertain that the safety-valves be sufficient to pass all the steam which the boilers can generate in their ordinary state of work, at the pressure determined by the weight on the valves; the maximum of which pressure shall be fixed by the maker of the engines, or boilers, and the valves be loaded accordingly.

5. That, after an assigned period, no passenger license be granted to any vessel having safety-valves whose spindles or levers are exposed on deck, or capable of being loaded externally, unless satisfactorily protected. Penalty on engineers, masters, or others, for loading valves beyond the weight ascertained by the surveyor, and regulated as above.

6. That, in all new steamers; and, after an assigned period, in all steamers, now afloat, glass water-guages, and mercurial pressure-guages shall be required to be fitted to the boilers, to entitle the vessels to a license to ply with passengers.

No perfect mechanical substitute can be found for *care*, in the management of the steam-engine at sea, or on land; nor do we think that the use of the fusible discs enforced by the French laws, would be productive of additional security; nor, indeed, that any complexity of apparatus, attached to boilers, would contribute to the attainment of that object.

Apparatus, however, for indicating the level of water, and pressure of steam in boilers, is essential to the safe and economical management and is of far greater import to the boilers of marine, than of land engines; accidents to the former, or failure in their supply of steam, being attended with peculiar dangers and disasters at sea, from which land boilers are exempt. Yet, it is a fact, accounted for, perhaps, by the circumstance of steam-vessels being owned and managed, generally, by persons unacquainted with the nature of the steam-engine, that these simple instruments are much more rarely to be found attached to marine, than to land boilers, which latter are usually under the direction of parties of mechanical education, or knowledge.

7. That, in the event of the surveyor having information that any boiler be deteriorated in strength, or unsafe at its working pressure, in the interval of his periodical surveys, he shall be empowered by the Board, on his representation, to examine it; and in the event of the boiler proving faulty, the Board shall suspend the passenger license, until satisfied of the safety of such boiler.

8. That no steam-vessel be permitted to ply which is not furnished with a binnacle and compass, in good order.

9. That, after an assigned period, no sea-going steam-vessel, which carries coals on the tops, or about the sides of the boilers, shall be entitled to a passenger license; unless the boilers be protected by a shell of metal, or other sufficient security.

10. All river steamers to carry one effective boat—coasting and channel steamers two, or three boats, according to their size—and ocean steam-ships, four boats—as a minimum.

The surveyors to ascertain that these boats be kept in serviceable condition, and ready for use on emergency.

11. All steamers to be provided with sufficient hoses to convey water to any part of the vessel, with a serviceable outfit of water buckets; and a moveable fire-engine to be carried in all coasting, channel, and ocean-going steamers.

The proposed system of Registration should include a Classification of steamers; and as the character, to which each vessel would be entitled in its class, would depend on its general state of efficiency, we are disposed to think that many other important requisites for attaining the utmost practicable degree of security, would gradually be adopted by owners, without compulsion; *such as water-tight bulkheads* in new vessels; *powerful extinguishing* pumps, worked by the engines; connection of the condensers with the bilge-water; disengaging apparatus for the paddle-wheels; heavier and more effective ground-tackling, &c. The publication of accidents and of their causes, would also warn steam-vessel owners, commanders, and engineers, and instruct them how to guard against disasters.

In framing these recommendations, our object has been to suggest practical means for further securing public safety, without inflicting vexatious rules on steam-vessel owners; we believe that their adoption would tend materially to promote, and, in no respect, to cripple the progress of Navigation by Steam. We are confirmed in these views by finding them so much in accordance with the majority of opinions expressed in the Appendix, and they correspond with several of the regulations enacted by foreign states. They are, however, much less stringent in their nature than those proposed by many of our correspondents; and we consider them much less onerous, and more suitable to the peculiar character of the British steam-marine, than the laws of other countries. An abstract of these laws is annexed, and the whole are given in the Appendix.

There is one additional measure strongly advocated, but we feel great doubts of its practicability; viz. that of compelling the engineers employed on board steam-vessels to undergo preparatory examination, and to find surety for their good behaviour. There is no existing Board at the different ports competent to determine the fitness of this class of men for their occupations; and we think it would be difficult for any local surveyor to decide on individual qualifications. Important as we think it is to raise the grade of enginemen—who have, in fact, in their hands, the lives of all on board,—we are of opinion their means of doing injury to life or property would be so much abridged by the foregoing regulations, that it would suffice to impose a penalty upon them, for any wilful abandonment of duty, gross negligence, or drunkenness.

We, also, feel considerable hesitation in offering any suggestions as to limiting the number of passengers in steam-vessels, a measure which has been strongly urged upon our attention. *Cabin* passengers take care of themselves, and will not go on board, unless there be adequate accommodation; not so, however, *deck* passengers; from the increased number of whom alone, danger is to be apprehended.

Legislation, with respect to the number of passengers, must have reference to the tonnage, either by builder's measurement, or by register; but the stability of the vessel

in carrying a load of passengers *on deck*, or in carrying a due proportion of sails, is materially affected by the weight and condition of the cargo under deck. Our difficulty on this subject is, therefore, much increased by the circumstance that a vessel carrying cargo, under deck, is, for that very reason, better qualified to take a *deck-load* of passengers with safety, than vessels, although exclusively appropriated to passengers; in consequence of the greater stability which vessels acquire, in a sea-way, by reason of the weight of cargo carried below.

In order to diminish the frequency and danger of *collisions*, and being convinced of the necessity for establishing a definite "rule of the road," and an uniform system of signals, for the government of steam-vessels, we should have introduced into the foregoing outline, distinct provisions on the subject, had it not been that a measure of this kind has been advised in the Report of the "Commissioners appointed to inquire into the Laws and Regulations relating to the Pilotage of the United Kingdom," to be incorporated in a new Pilot Act. Referring, however, to the tenor of our instructions as to "the nature of the accidents in steam-vessels," and to "the means of preventing them," and on a review of the valuable information supplied to us on this head, we cannot avoid recommending the adoption of a system which has for so many years been found practically efficient,—against which no objections have hitherto been urged,—and which has met the concurrence of so numerous a body of steam-navigators. The system we advise is:—

1. As to the "rule of the road:" That steam-vessels approaching and passing each other, should *starboard* their helms, with the view of keeping on the starboard side of each other, respectively, as far as practicable.

2. As to night signals: The want of an uniform and sufficient system of lights has been so fruitful a source of collision and injury, we recommend a system similar to that now practised by a numerous class of commanders of private steamers, and which has been substantively approved of and adopted by the commanders of Her Majesty's steam-packets at Liverpool, viz., that in all *sea-going* steam-vessels there be "a *white* light at the foremast head, visible in clear weather from 8 to 10 miles,—a *white* light attached to the fore part of the *starboard* paddle-box, which can be seen 6 miles in clear weather, —and a third light, which is *red*, attached to the fore part of the *larboard* paddle-box, *visible about* 3 miles. The three lights can *only be seen at one and the same* time when *right a-head, or nearly so; in* any other position, before the beam, two only are visible, and their colours define the position of the vessel."

3. That the obligation to carry some powerful steam-whistle, bell, or gong, be part of the proposed law, as regards steam-vessels; also that their rate through the water be defined, during fog, and thick weather, in crowded waters, whether plying by day or night.

It is, also, obvious that some regulations are essential to determine the nature, and enforce the carrying of lights in river-steamers, sailing-vessels, and vessels at anchor.

In submitting these recommendations, we are justified in our expectations of their producing the desired effect, by the concurrent opinions of two Select Committees of the House of Commons; and we cannot more satisfactorily conclude our Report than with the following extract from the Report of the last Committee, dated 14th October, 1831, since which period we have shown such numerous and calamitous disasters to have occurred:—

"Your Committee submit that the legislative enactments to the foregoing extent, cannot prove onerous or detrimental to the proprietors of steam-vessels, in any degree to counterbalance the security and satisfaction they are likely to afford the public; but that, on the contrary, it is probable they will eventually prove advantageous to the steam-boat proprietors themselves, from the increased confidence which will thereby be created in this mode of conveyance."

ARTIFICIAL PRODUCTION OF RAIN.

Mr. Espy's theory of storms was referred to and explained by Prof. Bache, at the last meeting of the British Association; and in the January *Edinburgh Review* it was said that if the "*new theory* does not succeed in supplanting its rival, it cannot fail to lead the abettors of both to a more rigorous examination of their data." This is rather respectful, considering what Mr. Espy claims. What this is, I wish to explain, and it can now be done satisfactorily, inasmuch as the theorist has been induced to come out with a full exposé. His object, then, is to manufacture rain, say in time of drought! Mr. Espy begins by laying down these principles:—1. It is known, he says, that if air should be expanded into double the volume by diminished pressure, it would be cooled about ninety degrees of Fahrenheit. 2. I have shown, he says, by experiment, that if air at the common dew point in summer, in time of drought, 71 degrees, should go up

in a column to a height sufficient to expand it by diminished pressure into double the volume, it would condense into water or visible cloud (by the cold of expansion) more than one-half of its vapour—a quantity sufficient to produce nearly theee inches of rain. 3. It is known by chemical principles, that the caloric of elasticity given out during the condensation of this vapour, would be equal to about 30,000 tons of anthracite coal burnt on each square mile over which the cloud extended. 4. I have shown by experiment that this caloric of elasticity would prevent the air from cooling only about half as much as it would, if it had no vapour in it, or about forty-five degrees at the height assumed, which would cause the air in the cloud to be, at that height, about forty-five degrees warmer than the air on the outside of the cloud at the same height. I have shown from these principles (*Journal of the Franklin Institute*, for 1836) that the barometer would fall, under the cloud thus formed, in favourable circumstances, as much as it is known to fall sometimes under the middle of a dense and lofty cloud; and that, consequently, the air would rush in on all sides towards the centre of the cloud, and upwards in the middle, and thus continue the condensation of the vapour and the formation of cloud and the generation of rain. I have shown, also, that the air does move inwards on all sides towards the centre of the space or region where a great rain is falling, and of course upwards, after it comes in under the cloud, which is so much lighter than the surrounding air; at least, that it does so in all storms investigated, which now amount to sixteen, besides several tornadoes, in all of which the trees were thrown with their tops inwards. From these principles, established by experiment, and confirmed by observation, it follows, that if a large body of air is made to ascend in a column, a large cloud will be generated, and that that cloud will contain in itself a self-sustaining power, which may move from the place over which it was formed, and cause the air over which it passes to rise up into it, und thus form more cloud and rain, until the rain may become general; for many storms which commence in the West Indies, very narrow, are known to move from the place of beginning several thousand miles, widening out and increasing in size, until they become many hundred miles wide.

Mr. Espy now goes on to say, that if his reasoning be correct, thus far, great fires and the bursting out of volcanoes should make rain; and he thinks there is proof that they do so. From some of these prin*ciples, too, it might be expected* that clouds *would form over large cities* and towns, *where much fuel is burnt*; and Mr. Espy says it is found to be so. He refers to Manchester for proof, and also to Mamett's statements, in his collection of facts concerning the Ashby Coal-field. The connexion, then, he argues, between fires and rain, is not accidendal. "Humboldt acknowledged this in the case of volcanoes, when he speaks of the *mysterious* connexion between volcanoes and rain, and says that when a volcano bursts out in South America in a dry season it sometimes changes it to a rainy one." Mr. Espy, of course, thinks that he has cleared up this "mystery," and that what applies to volcanoes applies to other fires in proportion. He explains why they do not *always* make rain, and states that he is willing to undertake experiments in proof of his argument, provided Congress or the Pennsylvanian Legislature will reward him in the event of his being *successful*.

EXTENT OF THE AMERICAN LAKES.

An interesting statement respecting our great north-western lakes, appears in the late Report of the "Michigan State Geologist,"—a region, by the way, which has been but two or three years a *State*. The following is the only authentic tabular view of these waters I have seen; it may be a novelty to some of your readers:—

	Mean length.	Mean breadth.	Area, sq. miles.
Superior	400	80	32,000
Michigan	220	70	22,000
Huron	240	80	20,000
Green Bay	100	20	2,000
Erie	240	40	9,600
Ontario	180	35	6,300
St. Clair	20	14	360
			90,060

The same tabular statement exhibits also the depth and the elevation of each above tide water.

	Mean depth.	Elevation.
Superior	900 ft.	596 ft.
Michigan	1000	578
Huron	1000	578
St. Clair	20	570
Erie	84	565
Ontario	500	232

It is computed that the lakes contain above 14,000 cubic miles of water; a quantity *more than half of all the fresh water on the earth*. The extent of country drained by the lakes from Niagara to the north-western angle of Superior, including also the area of the lakes themselves, is estimated at 335,515 square miles.—*Athenæum*.

DESCRIPTION OF FRENCH HORIZONTAL WATER-WHEELS, CALLED "TURBINES."

M. Savary read a report (to the Academy of Sciences, Paris,) in his own name, and those of M. M. Prony, Arago, and Gambey

on a memoir of M. Morin, containing the result of experiments on the turbines of M. Fourneyron.

Under the general name of turbines is understood water wheels which have scarcely anything more in common than that of turning on a vertical axis. Those which an engineer, M. Bardin, invented and first made known under this appellation, receive the water at the top of a vertical cylinder or drum, and discharge it at the bottom. The water enters and issues near the circumference, and runs along spiral channels bent round the surface of the drum, which must be half as high as the whole disposable fall of the water.

In the turbines of M. Fourneyron, the drum is never very thick, a foot or so, for example. The water rushes obliquely in horizontal jets round the contour of an internal vertical cylinder, and enters all the compartments of the wheel, which, in its revolutions, just clears this cylinder, presses upon the curvilinear buckets which lie between the horizontal bases, and escapes horizontally by a vertical aperture in the exterior drum.

We may form an idea of the turbines of M. Fourneyron by supposing a common wheel with curved pallets to lie flat, and that the water, entering the pallets in the centre, issues at the circumference.

M. Poncelet proposed, in 1826, an arrangement the reverse of that now mentioned —the water entering at the circumference and passing off at the centre. It will be sufficient to state, that the experiments of M. Morin on the turbines of M. Fourneyron, lead to the conclusion that they are, at least, as advantageous as the best wheels of the ordinary kind;—in fact, under falls which varied from the weak value of 1 foot to those of 1, 2, 3, and 7 or 8 yards, the disposable work of the turbines amounted to 7 or 8 tenths of the motive power. This is the effect absolute. With regard to the variable circumstances under which a hydraulic mover may be placed for useful purposes, the reporter states that the turbines present some special advantages. They are, he says, in reality, of all kinds of hydraulic wheels, those which, under the least bulk, are available with the smallest quantity of water. The water which propels them does not press upon the axles. The immense velocities, and the variable velocities which they are allowed to take without sacrificing anything of their effect, admits, in many factories, of the suppression of the wheel work and the heavy axles which are designed to transmit, with accelerated motion, the slow movement of the great bucket wheel.

Another property of the turbines is still more important. M. Morin, as well as other engineers, observes that they operate as well when immersed, (noyées) as when out of water. Perhaps it would be as well to admit, in such a case, of a slight difference.

At more than the depth of a yard under water, the liquid sheet escapes from the buckets with as much facility as at the surface. The action depends only on the difference of level between the upper and lower part of the current, and not upon the absolute height of either. This is a most valuable property of the new wheels, as it renders the entire fall of water available under all circumstances.—*L'Institute.*

NOTES AND NOTICES.

National Swimming Society.—This Society, whose machine for teaching swimming we described in our number for January 12th, has announced a swimming race, to take place in the Thames, opposite the Baron de Berenger's, on the 26th instant. Three silver medals will be given to the best swimmers. We are informed that nearly 700 pupils are in the course of tuition by the machine referred to. A silver medal is offered by the Society for the best essay on the *utility* of swimming, to be delivered before the 31st of December, 1839. We wish the Society the public support which it is undoubtedly entitled to.

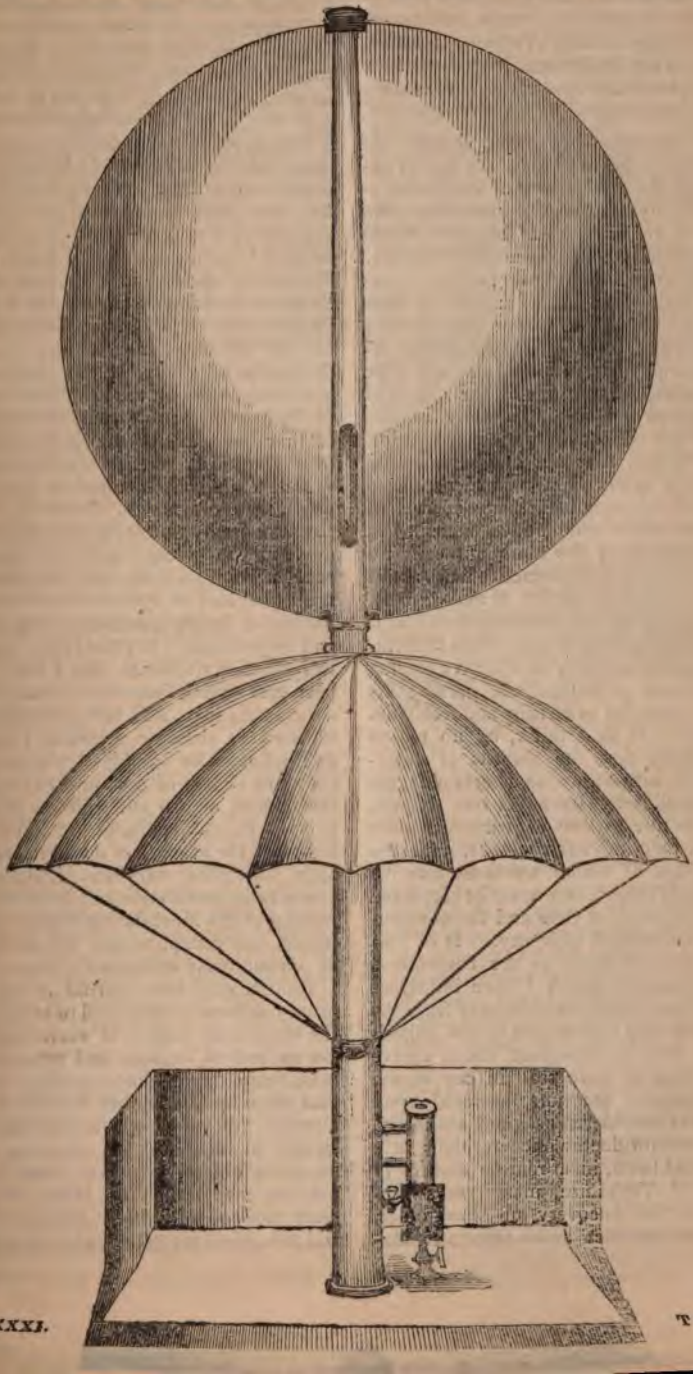
New Type Metal.—A type-founder of Clermont, named Colson, has obtained a patent for a new material for printing types, which is harder, capable of more resistance, and yet less expensive than the ordinary composition of lead and antimony. It is well known that types cast from the latter soon become worn, especially since the introduction of machine printing. Colson asserts that the material is so hard, that the types themselves will serve for punches in striking a matrice, and that it will last ten years without being more worn than the usual compositions in one year. If experience should prove the metal to possess the qualities claimed for it by the inventor, it will be of the utmost importance in printing in general, and to newspaper and periodical printing in particular.

Errata.—Number 829, page 218, col. 1, line 20, for "now had A and B worked separately for 1 minute, each 20 would be the leakage," read "had A and B worked separately for 1 minute each, then 20 gallons would have been the leakage for that time." Again, col. 1, line 15 from the bottom, for "$25 \times 20 \times 40 \times 200 \times 12\frac{1}{2} \times 12\frac{1}{4}$," read "$25 + 20 + 40 + 200 + 12\frac{1}{2} + 12\frac{1}{4}$;" — in col. 1, line 3 from the bottom, for "$\frac{2000}{40} \times \frac{125}{25}$," read "$\frac{2000}{40} + \frac{125}{25}$;" — last line from the bottom, for "$\frac{2000}{80} \times \frac{125}{25}$," read $\frac{2000}{80} + \frac{125}{25}$;" — col. 2, line 1, for "$50 \times 40 \times 25$," read "$50 + 40 + 25$;" — col. 2, line 2, for $50 \times 80 \times 25$," read "$50 + 80 + 25$."

The thirtieth Volume of the *Mechanics' Magazine* is published, illustrated with a splendid Engraving of a LOCOMOTIVE ENGINE, on the scale of $1\frac{1}{2}$ in. to a foot—exhibiting the whole of the machinery of the engine, and explaining its action.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 6, Peterborough-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE
No. 833.] SATURDAY, JULY 27, 1839. [Price 6d.



MEMORANDA ON AEROSTATION; BEING SUGGESTIONS DESIGNED TO PROMOTE THE OBJECTS OF THE SCIENTIFIC AERONAUT, THE IMPROVEMENT OF AEROSTATIC MACHINERY, AND THE GENERAL ADVANCEMENT OF AERONAUTICS.—BY W. H. WEEKES, ESQ., SURGEON, OF SANDWICH.

We presume but little doubt can exist that a desire to visit the higher regions of the atmosphere of our globe,—impelled by the thirst of knowledge, the hope of realizing ideas happily created by the irresistable advance of civilization, and the acquisition of new power,—must have had place in the minds of men many ages anterior to the period from which we can date such enterprizing attempts and their ultimate success, after numberless frustrations of the object of this grand scheme. However remote the origin of such projects, I think it is obvious that not only civilization but even science must have produced material influence before any species of practical effort would have ensued, for, notwithstanding the abundant cant we are sometimes accustomed to hear, about the beautiful simplicity of *savage man*, nothing can be more certain, than that it is only in the very highest state of civilization, man becomes an attentive listener to the voice of nature, and permits his mental energies to be fully and freely developed. It is, I think, by no means improbable that the records of enterprizes in aerostation, to a certain degree successful, may have become extinct, prior to our earliest acquaintance with any history of such events, and the knowledge of which we must now be content to reflect, can never be recovered from the gulph of time and the accumulated materials of antiquity. It is, perhaps, some warrant to the conjectural observations in which I have indulged, and is even more extraordinary from the comparatively recent date of the experiments, that I remember about twelve years since to have read in one of the periodicals of the time, narrated upon what was considered as good authority, that a certain doctor once resident in a provincial town, in a remote district (I think) of Yorkshire, many years *previous to* the discovery of Montgolfier, *used to construct small* aerostatic machines, which were made to ascend for the amusement of himself and his neighbours.

Many years have now elapsed since aerostation began to be spoken of as a *science*, but, notwithstanding the many ingenious schemes planned, and efforts exerted in its behalf, even up to the present day, it has scarcely approximated to a first claim on the appellation: the contumacious bantling has hitherto proved itself so unworthy, and imperfectly tractile, even under the most skilful masters, that I fear it will be found "on examination," to possess very little more "science," than what it derived at the outset of its career from the hand of the chemist; namely, the power of ascending to vast altitudes, and floating through the region of clouds at the pleasure of the winds, often to the imminent hazard of the lives of its professors, and destitute of that government ordinarily exercised over the most humble description of vehicle employed by man in his daily avocations. Be it observed, these remarks are by no means intended to be made in the gloomy spirit of despondency, nor with a desire that they may be construed into an opinion of the hopeless nature of future speculation, ingenuity, and experience. On the other hand, I beg distinctly to state, that I have long been one among those who contend that aeronautics may, and *will* ultimately, be reduced to absolute scientific formula, and balloons be employed with almost the same degree of certainty to navigate the regions of our atmosphere, in order to visit distant lands, as we have long traversed the expanse of ocean in another form, for similar purposes. I, therefore, conceive its cultivation as a science to be worthy of the most daring flights of intellect, and conspicuously characteristic of the sublimity of human genius.

From a very early period of life my mind has been accustomed to experience the most acute degree of excitement on the subject of balloons and aerostation; it is, therefore, an almost natural result, that my attention should have been frequently directed to various schemes designed to facilitate the progress of a favourite object. During many years past my memoranda on these subjects have consequently been accumulating, and the recent revival of public attention,

as well as the exertions of scientific individuals thereto, has unavoidably recalled my own thoughts to a variety of notes, long since written, and which would, in all probability, otherwise have remained forgotten. The substance of the following suggestions—for in such light only I would beg that they may be received—has been principally derived from the memoranda to which I have alluded; they may or may not be worthy of the attention of others, habituated, like myself, to experiments in this department of science; and my only apology, if any should be required, for offering them in a public form, shall be the simple fact—the existence of a hope that they will not prove entirely devoid of interest or utility to such as are engaged in the cultivation of aeronautics.

The construction, mode of inflation, and management of the hydrogen gas balloon, having undergone no material change since its original invention, we presume that not only the scientific, but the general reader also, is sufficiently familiar with the subject to join us in reviewing the several parts of the aerostatic machine as now used, and which we think may fairly be considered as labouring under the disadvantages, both in form and practice, to which we shall now solicit attention.

The immense net-work requisite to enclose a balloon of large dimensions being necessarily drawn over the latter before its inflation can be commenced, the former is exceedingly liable to be frequently entangled, and I have usually observed the attention of two or three persons necessarily engaged in adjusting this most obnoxious appendage, during the first hour of the process of inflation. To the efforts of these two or three persons must subsequently be added the services of several others, who will find enough to do in preparing and holding the ropes which confine the balloon, as the inflation advances, and by means of which it is usually secured until the aeronaut has affixed the car, and completed every arrangement preparatory to his voyage. To all who are conversant with the nature of such a process, it will be sufficiently obvious that these several assistants are constantly obtruding in the way of each *other, while the expenses* incumbent on the outfit for an aerial voyage are thereby materially augmented, and the entire proceeding is rendered clumsy and fatiguing. The weight of the net-work superadded to that of the balloon, moreover, offers no inconsiderable degree of resistance to the passage of the gas; the process of inflation is thus rendered more tedious. As economy, both in regard to money and time are important considerations in all philosophical pursuits, but more especially in the present instance, I venture to conclude that the usual net-work appended to balloons constitutes an incumbrance and creates impediments which it would be exceedingly desirable to remove. But a worse, because a more serious evil, in its consequences, arising from the employment of a net-work, is the constant wearing of the silk bag occasioned by the action of this part of the apparatus; for I am persuaded—and on good authority too—that instances have occurred in which the rupture or bursting of a balloon has been mainly occasioned by the abrasion of the silk membrane from the continued friction of the cordage constituting the net-work. Such a result, indeed, would appear to be an unavoidable consequence of the incessant action exerted during a few aerial voyages.

Against the form of car I have hitherto seen employed,—though it has the sanction of general opinion in its favour from the earliest era of aerostation, and is still recommended by all writers upon this subject,—I think we may also be fairly allowed to enter our protest, especially as we are sanguine in our expectation of showing cause against it, were it for no other reason than its being minus of convenience and adaptation to the philosophical objects of an aerial voyage. The model of a boat, after which the balloon car in present use is evidently constructed, was no doubt suggested from the circumstance that experience had long proved its suitability to the navigation of a more dense medium than air, and aeronauts appear to have regarded this form as being equally adapted to the transportation of man, both in air and water. Perhaps this error (for error, I believe it is,) has originated in not maturely reflecting that the transit of a boat through the water—for which pur-

pose its form is admirably fitted—is effected wholly by the exercise of power from within itself, and is in principle tantamount to the endowment of the boat with a specific action upon the surrounding medium, in steering, propelling, &c. But this principle cannot be transferred to the boat-formed car of the balloon: the parity of reasoning ceases, for the conditions are no longer the same, and the fancied resemblance of action vanishes before the light of inquiry. No power, I imagine, of the least importance in a practical consideration, can be exerted from within the car over the surrounding atmosphere; for in this instance the only efficient cause—the primum mobile, as it were—must reside, if at all, in the balloon itself, and, in no respect that I can conceive, in the car as annexed by the usual flexible rope medium by which it is merely dragged along as an appendage to the locomotive part of the machine. Therefore, in as far as the direction and velocity of a passage through the air is to be regarded, the form of the car can be of secondary importance only; the ascensional and governing power of the balloon—to say nothing of the force of currents—being of necessity (or it would be useless) more than adequate to supercede every effort of this nature from within the car, in the present form of our aerial ship, and, moreover, all such efforts, in whatever way directed, would seem to be useless, unless exerted from that part of the machine in which the motive power is resident, or otherwise in an appendage having an *inflexible* connection therewith. These considerations will, I think, satisfactorily account for the total want of success which has attended the employment of a species of oar in a few instances resorted to by the earliest cultivators of aerostation. Hence, then, in the absence of any evidence to the contrary, it appears that the shape of the car might as well be made to resemble a pear, a cube, a spheriod, or, in fact, any other indefinite form, since it contributes nothing to the means of direction through the air, and would seem to offer scarcely any other resistance from that which *arises from* its absolute weight. What, *then, should hinder us from* adopting *another form of car, better* suited to the convenience of the aerial traveller, and the objects of such a voyage?

The proper views by which our choice should be directed in the formation of an aeronautic car, appear to me to be principally two—personal convenience and security: there should be ample room for the arrangement, fixing, and stowage of philosophical instruments and other apparatus, as well as sufficient space for the operations of the scientific aeronaut. None of these purposes, I submit, are likely to be enhanced by the use of the narrow, shallow, and curved figure of the common car, but I am convinced they are all to be anticipated from the adoption of the parallelopipedon, having its longest diameter attached to the aerial machine in an horizontal direction.

I have always regarded the mode by which the car is attached to the iron ring of the net-work, if not exceedingly insecure, at least incompatible with the objects of any voyager, except the mere adventurer who ascends for the gratification of public curiosity; and in support of this opinion I will offer the following suggestions. The car being suspended by a flexible medium of ropes, if the occupant removes ever so little from his position in the centre of the vehicle, he will also change the centre of gravity, and the equilibrium and horizontal position will be instantly destroyed. If there be two aeronauts, one of superior weight to the other, or if the one rise up while the other remains in a sitting posture, the same disturbance of equilibrium takes place; in short the occupant must remain nearly motionless, unless he is prepared to encounter the disadvantages of dangling to-and-fro, in momentary jeopardy of "toppling down headlong"—no pleasant anticipation, methinks, at an elevation of several thousand feet in the air. This picture is not one of imagination alone; I know that such disadvantages—not to say dangers—actually occur, and must of necessity be a consequence of the inefficient means usually employed. It is not long since that, in company with a scientific friend, I witnessed the ascent of a female adventurer, who, in a few seconds after quitting the earth, excited a thrill of horror among the spectators, by incautiously removing from her central situation and stooping at the same time for the purpose of discharging

ballast, by which act she brought the treacherous vehicle of a car almost into a vertcial position, but by suddenly relinquishing her design and clinging firmly to the side ropes, she succeeded with difficulty in saving herself from being precipitated to the earth from a height of several hundred feet. From this and several other instances which have come within my own knowledge, I conclude that the best we can venture to hope from a car of this crazy form is, that with an adequate degree of caution life may be preserved, but it furnishes no facilities whatever for philosophical experiment, or any other especial object which might attach to the motives of a voyage. These can only be ensured by such an arrangement as will conduce to secure the car constantly in one position, and that position such as will render the base or floor of the car a *permanent* line at right angles with a second line which may be conceived to be drawn perpendicularly through the centre of the balloon.

The aeronaut having so far completed his operations as to leave the earth, regulates his elevation while traversing the regions of the atmosphere, by an occasional change in the specific gravity of his machine, and this change is governed by the employment of alternate powers, the one arising from the liberation of gas from within the balloon, and the other from the discharge of ballast which has its stowage in the car occupied by the aeronaut. Thus, we will suppose him to have reached the altitude of 2500 feet, and he finds it expedient to descend to a lower stratum of air, he opens a valve in the balloon by pulling the line attached thereto, and a portion of the gas is liberated, causing a loss of aggregate power which cannot be recovered during the voyage. In consequence of this escape the specific gravity of the machine is increased beyond an equal volume of atmospheric air in immediate contact therewith, owing to a reduction in the volume of the balloon, and an equal volume of the surrounding medium is no longer adequate to its support at the same degree of elevation, the balloon therefore descends with a rapidity proportionate to its change of specific gravity. But if, on descending 1500 feet, and being within 1000 feet of the earth's surface, it becomes *either necessary or* desirable to reascend, the aeronaut again effects a change of specific gravity opposed to that which he first called to his aid; in short, he throws out ballast (commonly consisting of bags of sand) from the car, until he renders the whole amount of apparatus, &c., specifically lighter than an equal bulk of his aerial medium, when the balloon immediately reascends. These changes may continue to be wrought repeatedly, so long as the stock of ballast is not exhausted, and the volume of gas within the balloon retains an ascensional force superior to the weight of the silk bag, cordage, car, passengers, &c., but in this mode of regulating the ascent and descent of the machine, we at once perceive some palpable disadvantages and a deficiency of scientific application. In the first place the ballast occupies room not easily spared in the small car, or which, to say the least, might be much better devoted, while its employment, by augmenting the first weight of the aerial machinery, calls forth the necessity of putting into requisition a greater quantity of gas originally to enable the aeronaut to commence his ascent. Again; though the operations to which we have alluded can in most instances be repeated several times, we can have no absolute dependence on them for any definite period during our stay in the atmosphere, because both powers must ultimately become exhausted, and then the aerial voyager has no alternative but to descend to the earth, let his designs or his situation be whatsoever they may. Independent of these considerations, it is no immaterial objection, that the gas which must be permitted to escape when the aeronaut wishes to descend is, as a matter of course, irrecoverable, so that when his ballast is expended and his machine become specifically heavier than an equal volume of the surrounding atmosphere, he cannot reascend to a higher altitude, or make a second voyage after alighting, without the aid of an additional supply of gas, which circumstances do not admit of obtaining with the same facility as relays of horses are procured at ordinary stages, nor is it probable that such local advantages can ever obtain while we are necessitated to continue our present mode of inflating balloons.

The awkward and unscientific means usually employed to secure the balloon

during the progress of inflation up to the time of its ascent, by passing ropes over its zenith, and entrusting the management of them to assistants who cast off the restraint when the word is given, has been already adverted to, and I may add, that it has ever appeared to me, that the aeronaut should be rendered as independent as possible of aid from others at the moment of his departure, which it is exceedingly desirable he solely should be enabled to command on the occasion of the moment. I have therefore just received the information with pleasure, that our intrepid aeronaut, Mr. Green, has adopted an ingenious and safe mode of detaching his balloon by withdrawing what is designated "the liberating iron," but with the principle and construction of this contrivance I am unacquainted.*

I feel persuaded that an unnecessary degree of alarm has generally prevailed respecting the amount of danger supposed to be attendant on an aerial voyage. Very little, I presume, can be incurred after the balloon has fairly cleared the earth, until the aeronaut prepares to descend, and serious consequences can only obtain from a too rapid descent, or an unfavourable landing place: the first occasions violent and dangerous concussion and rebounding, while the latter is fraught with a multitude of serious and disagreeable contingencies.

I trust that I have now fairly attempted to show the defects existing in our present system of ballooning, and also the nature of the imperfections under which the aerostatic machinery itself has laboured, without material improvement, from the earliest era of its invention. I am quite aware how much easier it is to find fault with things than to mend them; yet, however visionary the suggestions I have now to offer may be found in a practical consideration, I shall always remain under the conviction that *it is practicable* to render the means of travelling by a balloon quite as safe and certain, if not more so, than the chances of a modern stage coach, and I shall therefore submit the subjoined "scantlings" of a plan for an aerostatic machine, designed (partly from experimental results) more than twelve years since, and, whether practicable, as I believe it is, or not, I shall tender it with that confidence which an unqualified lover of scientific research, having no other object in view but the development of useful truths, feels he shall obtain with minds of a congenial character, who, perhaps, may conclude with me that aerostation is destined hereafter to effect revolutions as gigantic as those already produced by the masterly engine of Watt, or as mighty as the results emanating from the still more modern voltaic battery of Davy.

It is necessary that the accompanying sketch (see front page,) should be regarded as an illustrative outline only, of the principles which I am desirous of explaining, nor is it introduced with a design to represent the minutiæ of machinery requisite in detail to carry the plans suggested into operation. It is therefore presumed that an occasional glance at the figure, without the aid of letters of reference, will be sufficient to render intelligible the following description:—

The machinery to which we now solicit the reader's attention, consists of six principal parts or divisions, namely, the reservoir, the car, the tubular mast, the balloon, the safety-awning and the condensing engine. I shall premise that I intentionally omit to specify any dimensions, as they must necessarily vary with the objects in contemplation and the power to be employed. The base of the whole machine, represented by the darker shaded part in the annexed figure, is constituted by an air-tight box (denominated the reservoir) of stout sheet copper, the upper, or horizontal surface of which forms the floor of the car, the side of the latter nearest the eye, being purposely omitted in the figure for the convenience of description. The car itself should consist of a strong light frame work of wood, covered with leather, such as is usually employed in the construction of coaches and similar vehicles, and ought to be provided with a box seat at each end, within which might be stowed the various articles of provision, and other requisites necessary to be kept from exposure to the atmosphere. In convenient positions against

* *A plan was described in Mech. Mag.*, vol. xxviii, p. 42.—Ed. M. M.

the inner sides of the car should be firmly fixed various brass hooks, pins and knobs, to which the aeronauts may securely attach their barometers, thermometers and other philosophical instruments, in situations where they may be instantaneously referred to by the eye, while the floor of the car is preserved clear for other occasional operations.

The circular opening seen in the side plane of the reservoir at the bottom of the car, represents the commencement of the tubular mast, fabricated, like the reservoir, from stout sheet copper. This, passing horizontally inwards from the aperture, seen as above mentioned, until it arrives at a point central to the cavity of the reservoir, is there soldered at right angles, and ascends perpendicularly through the floor of the car, and, continuing the same line of direction, traverses the balloon as an axis until it reaches the zenith of the latter, where the extremity of the tubular mast is hermetically closed; one or more longitudinal openings being cut in the copper for the ingress and egress of gas to and from the balloon. A screw-cap and leather collar is adjusted to close securely the opening at the lower extremity of the tube, as circumstances may indicate.

With regard to the figure of the balloon itself, perhaps it is not so important as some writers have insisted, since I think it is has been shown to possess little or no influence in directing the course of an aerial voyage, but I imagine the globe, spheroid, or pear shape to be as good as any, if not preferable on most occasions, and, as will be seen, I have supposed the former to be adopted. Nor do I suppose that our present acquaintance with the arts will furnish us with any better material for its construction (if regard be had to relative weight), than that of silk properly varnished, and from which the gas balloon is generally fabricated.

At a convenient distance, intermediate with the car and balloon, and firmly secured at the centre of its convex surface by means of a brass cap or annular band embracing the circumference of the tubular mast, is placed the safety awning, manufactured from strong whalebone or cane ribs covered with durable *varnished* cotton or *"India rubber cloth,"* and furnished on its concave side with brass or copper sliding rods attached below to a moveable ring of similar metal, as seen in the accompanying sketch. By elevating or depressing this ring the aeronaut may cause the awning to expand or collapse at pleasure, precisely upon the principle of the common umbrella, a spring fastning being adapted to retain it in its proper position when elevated. The diameter of this appendage should, at least, be equal to that of the balloon, and made of the strongest and best possible materials, in order that in case of accident to the balloon from rents, or during a too rapid descent from any cause whatever, it may be instantaneously expanded and converted to the purposes of a parachute in slowly bringing the ærial travellers to the earth uninjured, which office, I doubt not, this apparatus, if properly managed, is capable of performing effectually. In the event of sudden and heavy rains, hail storms, or great degrees of heat from the solar beams, &c., it will also be found to yield its advantages during a long, and occasionally perilous voyage, though the importance of these matters will be secondary only in comparison with the main object of this appendage.

As near to the tubular mast as the nature of its working machinery will permit, should be placed the condensing engine before mentioned, an idea or outline of which I have endeavoured to convey in our explanatory figure. The box of the engine at its lower part is connected with the copper reservoir by means of a strong gas cock, in the capacious opening or air way through the plug of which should be placed a secure valve, admitting a passage to the gas in one direction only, whereby, when the plug is adjusted in the right direction, the condensed gas may be prevented from receding back from the reservoir, or, by reversing the valve by a turn of the plug, allowed freely to escape therefrom in an upward direction into the balloon.* Laterally a second gas cock connects the engine box with the interior of the tubular mast, and within

* I may here suggest that this plan of placing a valve within the air way of the plug in gas cocks, is calculated to be exceedingly useful on many occasions. By the mere reversion of the plug alone, we thus instantaneously convert an ordinary engine to the purposes of exhaustion or condensation at pleasure.

the air way of the plug in this cock, is placed another valve constructed and regulated upon the same principle as the one already described, intended to cut off the return of gas to the balloon during the descent of the piston in the cylinder of the engine as the progress of condensation advances, a result which would otherwise unavoidably obtain, even under very moderate degrees of pressure, from the known elastic force of aeriform fluids in a state of compression. The cylinder of the engine ought to be firmly secured to the copper mast by means of metallic bands or holdfasts, held on by strong screws as may be best adapted to the occasion, but with the proviso of being readily detached when requisite for the purposes of cleansing and oiling the apparatus, repairing the valves, etc.

With regard to the necessary mechanical means of acquiring power to elevate and depress the piston of the condensing engine (and I am aware this power must occasionally be considerable), I have not attempted to introduce into the sketch either wheel or lever, being confident that ordinary ingenuity will readily supply the requisite means to a production of motive power. That of steam (were it not that its machinery might probably occupy too much space) would perhaps be entitled to the preference; for I fear we are not yet sufficiently advanced in our applications of electro-magnetism to such a purpose, otherwise we need not question its superior claims to employment.

Having thus completed an outline or brief description of the suggested machinery, I shall subjoin a few requisite observations relative to the mode of inflation and subsequent management of our aerial ship. Presuming in the first place, that the balloon with its appendages has been brought into an eligible situation, the car resting upon an even surface of ground to which it must be temporarily secured until the ascent takes place, by any the most convenient means, in the contrivance of which simplicity will be the strongest feature of recommendation, it is necessary to observe, that, hidden from observation in *the figure, and* at opposite ends of the *copper reservoir at the bottom* of the *car, the reader is requested* to suppose *two openings of about* an inch diameter, furnished with screw caps and leather collars, similar to the larger aperture at the bottom of the tubular mast already described. To one of these, previous to commencing the process of inflation, a small hose or elastic tube with correspondent screw is to be attached, and the other left open. By means of the hose a continuous current of gas should be sent into the reservoir for a few minutes, for the purpose of expelling the atmospheric air, which being effected, the hose may be removed, and both orifices closed by their respective caps. This measure is rendered necessary to prevent the admixture of a considerable quantity of common air with the atmosphere of the balloon during the subsequent operations. Let us suppose this preliminary accomplished, the end of another hose of adequate dimensions, and furnished with an appropriate means of union, is to be now adjusted to the aperture of the tubular mast, before described as opening from the side of the copper reservoir at the base of the car, when, the gas cock between the mast and engine being duly closed and a requisite degree of pressure exerted on the gasometer, the gas will rapidly ascend the tubular channel and inflate the balloon with a degree of expedition and facility incompatible with the usual mode, wherein the balloon is loaded and incumbered by a heavy network, ropes, &c. The process of inflation having been carried to the required extent, the tubular opening closed by its cap and collar, the safety awning placed in a state of collapse, the barometers, thermometers and general arrangement of instruments securely fixed in their respective places against the sides of the car, the aeronauts having taken their seats, and other necessary attentions being completed, it remains only to detach the holdfasts from their several grasps, and the balloon ascends as under ordinary circumstances by the buoyant power of hydrogen gas. We will now imagine our adventurers to have reached an altitude from which they are desirous of descending to a lower region of the atmosphere. The respective gas cocks connecting the tubular mast, engine and reservoir, are to be first attended to, and these being adjusted in their proper direction, the process of condensation may be at once commenced. As

the operation advances, by transferring the hydrogen from the balloon to the reservoir, the ascensional force of gas within the former will materially decrease, while a slight addition to the specific gravity below will have obtained, and the whole machine will descend until it reaches a stratum of air equivalent in buoyant power to the aggregate floating weight. It scarcely needs to be remarked that, if the reservoir be sufficiently capacious, and, together with the machinery, of adequate strength and power, the condensation may be carried to the amount of several atmospheres, which will give to the aeronauts every necessary degree of command for the regulation of their altitude. The operation of the engine may be continued until a complete descent is obtained, or, if, when within a short distance of the earth, it should become desirable to re-ascend, the condensation being now suspended and the gas cocks readjusted, the means of accomplishment to the aeronaut's wishes will immediately commence, and in the space of a few seconds, as the confined gas rushes impetuously from the reservoir to the balloon, he will find himself on his way back to the skies. Thus, without the aid of ballast of any kind, or the expenditure of ascensional or buoyant power (a consideration of vast importance) it appears practicable to regulate the altitude and perpendicular direction of balloons almost with mathematical precision.

Many years have now elapsed since I entered on a course of experiments and calculations, the results of which ultimately determined me on the application of the principles detailed in the foregoing suggestions to the management of balloons. Since that period I am aware that some hints have appeared incident to the employment of the condensing engine for a somewhat analogous purpose, but, in as far as I recollect, without any definite plan on the part of the proposer. The *Mechanics' Magazine*, which has rendered itself eminently conspicuous for its many valuable communications on aerostation, has most probably been the vehicle of the hints to which I have alluded. However, I am not at all disposed to contend on the question of originality; it will be amply sufficient *for my purpose if I* have shown the practicability of my plan, to which belief I am not only inclined, but have, I think, in its favour generally, the experimental results upon which my present suggestions were originally founded.

I find among my notes of the period formerly mentioned, a series of calculations deduced from actual investigation; showing the ascensional power of a balloon containing 33,510 cubic feet of pure hydrogen. Now, those who are familiar with pneumatic chemistry need not to be told that every cubic foot of this gas may be reckoned on as possessing a buoyant power or ascensional force equal to about one ounce averdupois, from which it will appear that the 33,510 cubic feet just mentioned will yield 1469 lbs. of the required power in question. This estimate was formed on an assumed spheroidal balloon of 40 feet diameter, to which form a preference had been given as containing the least quantity of silk, or presenting the smallest amount of surface compatible with a given capacity. The note proceeds to show that for the aggregate weight of machinery therein supposed, that is to say (according to prescribed dimensions, &c.) the balloon, tubular mast, safety awning, reservoir, car and aeronauts, a deduction of 1381 lbs. must be made, which leaves a remaining ascensional force of 88 lbs., a degree of power, I presume, much more than adequate, and capable of conversion to every design of the preceding suggestions.

A scientific friend who has long been acquainted with the plans herein detailed, and equally with myself convinced of their practicability, suggests notwithstanding—and possibly the idea will occur to others—that this form of aerostatic machine, owing to the permanent inelasticity of the connecting medium between the balloon and car, might be found peculiarly liable to contingencies, from the effects of high winds occurring at the moment of contact with the earth in making descents, when, he conceives, it would be difficult to secure an anchorage. These opinions are entitled to their proper weight, but the objections, I conceive, will apply with nearly equal force to the common form of balloon now known and employed during more than half a century. High winds are equally obnoxious to the aeronaut and the ma-

riner, neither of whom would be wise in attempting to navigate their respective elements in a storm, though such may arise when a voyage is nearly complete, and cannot always be foreseen or provided against, even by the sagacity of our friend *Murphy*. The question of effective anchorage, upon which the safety of an aeronaut so much depends, is, doubtless, one of first rate importance, and lays claim to our most attentive consideration. Experience proves that upon the means generally adopted we cannot implicitly rely, and much more both of ingenuity and experience must, I fear, yet be patiently exercised, ere we can hope to accomplish this great desideratum.

It affords me pleasure to perceive that the ingenuity of several talented individuals has lately been exercised upon scientific principles, with a view to elucidate the means by which balloons may be literally steered through the atmosphere towards any definite point of the compass, and I have no hesitation in believing, from the results of my own experiments, that such means are within the limits of our invention and control, and though my own essays with a design to promote the accomplishment of this object have tended to exhibit difficulties by which it is accompanied, I cannot but regard them as being indicative of that ultimate success which persieverance when united to legitimate theory will seldom fail to realize. I have occasionally met with some valuable information on this head from the pens of contemporaries, and from no source that I recollect in a greater degree than from a paper by Mr. John Lake, of Gayton.—*Vide Mechanics' Magazine*, vol. xxvi. p. 393. The simplicity and compactness of Mr. Lake's plan is, I think, conspicuous, while I conceive that the *principle* of his ingenious contrivance might be brought into operation with great advantage when exerted from either end of the car I have suggested, or a tube of adequate bore, proceeding from his "air compresser," might accompany the tubular mast, ascending above the awning to within a few inches of the terminus to the inferior vertical axis of the balloon, where, being carried off laterally, and capable of horizontal motion by means of a suitable joint, its power might be directed in giving impulse towards any required point of the compass, and thus supply a most essential ingredient in the consummation of aeronautic skill.

At page 396, vol. xxix, of the *Mech. Mag.*, I likewise learn with much satisfaction, that the talent and ingenuity of Mr. Baddeley are being exercised on this important subject. From him, also, I should certainly anticipate something valuable in a practical consideration, though, in the mean time, I cannot help supposing that he will ultimately conclude on adopting one of his "mechanical plans," in preference to any impetus that can be regularly derived from employing "the re-acting force given out by the combustion of a suitable rocket."

While circumstances render it expedient that we should resort to the manufacturer of carburetted hydrogen, or coal gas, in order to wing the chariot of the aeronaut, the necessity of employing balloons of much larger diameter than otherwise, must continue to operate, and ascents must as necessarily be limited to the immediate vicinity of certain localities. On another hand, the inflation of such machines by pure hydrogen from the decomposition of water, through the agency of any process yet made known, is not only too tedious, but too inconvenient and expensive for general adoption. The conversion of immense volumes of hydrogen gas to the liquid or solid state, by aid of some happy discovery in chemical and mechanical philosophy, forms the only source of hope to which we can, with any confidence, look for the removal of the obstacles alluded to, and which now materially retard the progress of this science, and postpone the climax of aeronautic ambition. In vol. xxvi, page 394 of the *Mechanics' Magazine*, in some "Observations on the Admeasurement of Compressibility in Gaseous matter, &c." I have ventured to anticipate the realization of this grand object, nor am I, upon the most mature reflection and experience, disposed to doubt the probability of its accomplishment from the unwearied exertions of genius, which will therein reap an abundant harvest of immortal fame.

That aerostation has hitherto contributed to our stock of philosophical knowledge much less than might have

been reasonably anticipated, is a fact too apparent for one moment to permit of disputation, and it assuredly constitutes an efficient source of regret that aeronauts generally should have exhibited a much greater prediliction for the gaudy paraphernalia of silk banners, and the *res pecunia*, than they have evinced to further the progress of science, by a judicious attention to experiment and observation at different altitudes above the surface of the earth. Through the entire progress of this department of science, its history presents—so far as I am aware—but one material exception to the ground of this complaint, and the solitary but splendid example to the contrary was set us many years since by the two justly celebrated Frenchmen, M. Biot and Gay Lussac, the latter of whom, in a subsequent ascent, reached the astonishing altitude of 23,000 feet above the level of the sea. The spirit of enterprise and scientific ardour displayed during these two interesting voyages will long claim the unqualified approbation of every generous mind intent upon enlarging the boundaries of human knowledge.

In concluding this paper I shall undertake to furnish a catalogue of instruments, and suggest some few experiments which I think might fairly entitle themselves to the attention of future aeronauts.

As we cannot conduct our ordinary terrestrial operations, or convey clear ideas respecting them to others, without a reference to time, so in regard to experiments and observations made in the regions of our atmosphere, a good chronometer claims the first attention of a voyager; to this must be added a mountain barometer of the most approved construction; one or more accurately graduated thermometers; Professor Daniell's hygrometer; a good compass and dipping-needle; a fine needle, carefully magnetised and suspended by a very delicate silk thread, for ascertaining, by its vibrations, the force of magnetic attraction, on the principle of torsion, an experiment formerly made by M. Biot and Gay Lussac, and which should be frequently repeated with minute attention; several small bars and pieces of iron for experiments on the magnetic apparatus; a small delicate electroscope; an electrophus; a stick of sealing wax, and several coils of copper wire, from twenty to two or three hundred feet in length, to examine the electricity of the different strata; De Luc's electrical column; a small voltaic sustaining battery; one or two porcelain dishes; several slips of copper and zinc; with a bottle of dilute sulphuric acid for the purposes of occasional experiment; the condensing air syringe usually employed to ignite the fungus called German tinder—to be used at a great altitude and the results noted; concave mirror and double convex lenses for experiments on the ignition of combustible substances by concentrating the solar rays. When an ascent takes place in a clear day, Leslie's photometer being priorly examined, might be noted at different altitudes, and the observations thereon prove interesting and important.

Researches in electro-magnetism at present absorb a large share of attention in the scientific world, and the more extended our experiments on this interesting subject become, the more speedily, of course, may we hope to profit from a comprehension of its mysterious agencies. Dr. Ritchie's rotating magnet might, therefore, be properly added to our list of apparatus, and its action carefully observed from time to time during an aerial voyage, Other subjects of enquiry will, doubtless, suggest themselves to the philosophical aeronaut, but I am particularly desirous of soliciting a little more attention to an old experiment which apparently has of late failed to induce repetition. I mean the bringing down portions of air from the higher regions, for the purpose of chemical analysis, by means of an exhausted flask, or the emptying bottles of water, and then securely closing them to prevent further access. Hitherto the most celebrated chemists have laboured in vain to detect a difference in the constitution of air taken from a crowded theatre or a close dungeon, and that on the highest mountain top; but surely this is indicative rather of inadequacy in the means of detection, than proof of strict analogy in the gases themselves—a question from which further investigation might possibly succeed in removing the mantle of obscurity?

NATURAL PARACHUTE.

Sir,—This morning, on perusing your useful Magazine for June, I found at page 201, an account of Mr. Hampton having detached a parachute from his balloon with a bag of sand suspended to it, and which, when separated, descended, as you express it, with frightful speed, "the frail machine collapsed and turned in all directions." What does this prove, Sir? Nothing more than that the principle on which it was constructed being decidedly wrong.

Herewith I have sent you in the box a few specimens of most perfect and beautiful parachutes, formed on correct mathematical principles, the truth of which you can test in a moment by the breath of your mouth, and the Author of them you will immediately discover to be of undoubted skill. In fact they are the seed of a plant called the stag's-horn, I believe, and which is now shedding its seed. I have, before to-day, observed this plant, and have tried a parasol with the under part turned upwards with complete success. All that need be done, I conceive, by any person of mechanical skill, is, to take the exact dimensions of the winged seed, and determine the proportion of the weight of the seed to the surface of the wing. Multiples of these up to the weight of a man will give the requisite dimensions for a parachute, which, if formed after this plan, will, you will agree with me in saying, descend to the ground from amid air, elegantly, gently, and safely.

I am quite of your opinion, Mr. Editor, in not seeing any good arise from these perilous adventures, and I have taken the liberty of sending you the enclosed, in the hope the models may be *the means of saving the lives* of those *persons who, by their conduct*, seem *almost bent on self-destruction*, merely to please the morbid appetites of the low-minded.

Believe me to remain,
Sir,
Yours very respectfully,
WM. BLAND.

Hartlip, near Sittingbourne, Kent,
July, 1839.

[We have appended to Mr. Bland's communication an engraving (natural size) of the stag's-horn, taken from one of the specimens sent to us. The suggestion is a very beautiful one, and deserving of the attention of those interested in aeronautics.—ED. M. M.]

GEARY'S PATENT COAL.

The formation of an artificial fuel has for some time past occupied no small portion of the attention of scientific minds. The high price of the natural mineral—the great space it requires for stowage—the quantity of its refuse, and the nuisance of its smoke, were amongst the disadvantages which it was sought to be overcome by some artificial combination of combustible matters. We have from time to time published accounts of the various patented methods of manufacturing artificial fuel and coal, and of various experimental usings thereof for steam-engine and other purposes, to which we have now to add, the particulars relating to another composition invented by Mr. Stephen Geary the architect.

Mr. Geary's artificial coal consists of a mixture of the following ingredients:—First, about half of small coal, or coal-dust; second, pitch, or bituminous matter obtained from coal, or other mineral or vegetable tar; third, coal or coke cinders, powdered peat, or bark of trees, sawdust or tan; fourthly, powdered clay, freestone, chalk, plaister, earth, sand, or other earthly matter; and lastly, about a fortieth-part of some acid—sulphuric acid, as the cheapest, is that which is used by Mr. Geary.

The coal is manufactured in the following manner:—The pitch is to be melted in a pot, and the cinders gradually introduced—stirring constantly. The powdered clay is next to be added gradually, then one-half of the small coal; as soon as these matters are well amalgamated—being kept at a good heat during the operation—the acid is to be

poured in, and well stirred through. An effervesence will in a short time take place, producing a froth on the surface of the mixture; and as soon as this appears, add the remainder of the small coal. The mixing of the ingredients having been completed, the fluid mass must be kept in a state of agitation by stirring until the whole is well and equally heated. The mixture may then be run into moulds of any desired shape. When the mixture has become partially cool, pressure or beating may be applied in order to compress the blocks of fuel into as small a compass as possible. The pressure or beating is not essential, except in cases where the coal is intended to be used as steam-boat fuel, where stowage room is valuable.

The ingredient in this composition, which is new, and from the action of which on the other component parts, the beneficial qualities of Mr. Geary's fuel result, is *the acid;* and he claims this addition of an acid or acids to the other matters which have all been used before, as constituting his patent.

Some specimens of coal thus manufactured were submitted to Professor Brande for his examination and opinion, who reported as follows:—

"That it burns well, kindles readily, and has most of the characters of some of the bituminous coals. It undergoes combustion rather more rapidly than the ordinary Newcastle coal, but appears to give out as much heat, and to form a brisk, agreeable, and efficient fire, and I apprehend no objection to it on the score of smell, dust, smoke, soot or ashes, and it is entirely free from any quality prejudicial to health.

"I have no doubt that it might be available in the manufacture of gas and coke, but whether economically or not is a question which I have no means of determining.

"Accurately to ascertain the relative value of this fuel, as compared with the ordinary varieties of coal, would require a series of experiments upon a larger scale than I have been enabled to undertake, but from the trials which I have made of it, it appears to me to compete with the superior kinds of coal, and if so, the greater number of its applications to inferior purposes are matters of comparatively little moment."

Mr. Squire (chemist in ordinary to her Majesty) also reported very favourably *of its merits in the following* terms:—

"I have examined the properties of the Patent Coal, which you placed in my hands for that purpose, and have to report that it makes a cheerful fire in the open grate, the temperature of the room being more steadily increased, and the maximum of heat longer retained by it than with common coal, and although it does not throw out so violent a heat as the best screened coals, yet it has the advantage, if left alone, of continuing to burn till all is consumed to ashes, leaving no cinders; it is entirely free from any unpleasant smell, and when burnt in close vessels it yields nearly the same quantity of coke as the best coals do, and the gas given off burns with great brilliancy."

These favourable opinions, we are happy to be able to say, have been confirmed by subsequent experience. The Commercial Steam Boat Company, in consequence of the beneficial result of some experiments they made, have adopted it for the use of their vessels. One experiment was in working the engines of the *Prince George* steam-boat from London-bridge to Chatham, Sheerness, and Southend. The same weight of Mr. Geary's coal was taken on board that was usually consumed in a trip to Chatham of common coal, and there was found to be sufficient to work the engines as far as Gravesend on the return voyage. Another trial was in the *Dutchess of Kent* steamer. The quantity of common coal usually burnt by this vessel in a voyage to Ramsgate is *five tons;* she performed the voyage with *three tons and a half* of Mr. Geary's Patent Coal. The price paid for the common coal by the Commercial Company was twenty-three shillings per ton. The cost of the patent coal is eighteen shillings per ton. From this there appears an enormous saving in cost, in stowage room, and in weight.

There are other advantages besides these which it is important to mention: the captains and engineers of the boats state that there are hardly any ashes left after combustion; no clinkers; only a light white vapoury smoke; and that the labour of stoking is much reduced.

We also understand that coke manufactured from the article has been used with great success on some of the railways, particularly the Eastern Counties'.

An extensive manufactory has been erected for the production of this patent fuel, in the neighbourhood of Bow, and another is in preparation at Graves-

end. Judging from the foregoing statements, we may venture to predict an extensive demand for this new article of commerce.

THAMES AND CLYDE-BUILT STEAMERS.

Sir,—I do not know what conclusion has been generally come to, with regard to the folly or wisdom of the owners of the *British Queen*, in sending her from London to Glasgow for her engines, after the correspondence which has appeared on the subject in your pages, but it appears to me that if any doubt remain on the point, it must needs be dispelled by the valuable report of Messrs. Pringle and Parkes on steam-engine accidents, which has graced your last three numbers. Safety is an article, surely, of the very first importance in every case, but especially so in that of a steamer which will have to "breast the broad Atlantic," ere it reach its destined port; and considerations of safety, therefore, may well be supposed to have had their weight, as well as *considerations of economy*, in inducing the selection by her owners of a port in which the Queen was to be fitted with her engines. Considerations of time could not have been much attended to, judging from the fact that, owing to the course adopted, this, the first vessel of the company, which it was expected would start "in the course of the spring of 1838," has, thanks to northern dispatch, only just left port on her first trip,—*now*, far in the summer of 1839!

But safety is every thing; the steamers of the Clyde are, doubtless then, famous for their excellence in this respect. It is on this head that the report of Messrs. Pringle and Parkes is most satisfactory, particularly when it is considered that these gentlemen were appointed by Government to make the inquiry they have been engaged in, and have no possible interest in the question, one way or the other. And what is the dictum of these competent authorities? "*Explosions*," they tell us, "*have been most numerous in the Clyde, or in Scotch-built vessels, both river and sea-going; the Corsair, Fingal, and Antelope, are of the latter class; the Earl Grey, James Ewing, James Gallocher, Hercules, and Dumbarton Castle, of the former.*"

Nor is this all, "the next greatest *number have occurred* in the Humber and Tyne steamers," that is, on board vessels which are often indebted to the engineers of the Clyde for their propelling machinery, as, for instance, the *Victoria*, whose boilers twice exploded, killing, in the whole, fourteen unfortunate individuals, although, *after all*, they were pronounced perfectly safe by their designer, a Glasgow namesake of the Glasgow engineer to whom the furnishing of the engines of the *British Queen* was confided! Safety, indeed! why Messrs. Parkes and Pringle's report makes known the astounding fact that *not less* than twenty-seven deaths have ensued from explosions of engines made or designed by this one Glasgow engineer. The report does not enable us to ascertain exactly the number of fatal accidents from the engines of London makers, but from the table given it results as certain, that, out of the grand total of seventy-seven, not more than half-a-dozen, at the utmost, can be attributed to them, and that the steamers of the Clyde and Humber are accountable for all but a fraction of the remainder.

What, then, could have been the inducement to send the "Queen" away from the very port in which she might have been fitted most efficiently, most expeditiously, and in every point of view most excellently? Why send her away from London, when even the very fittings of her saloon had to be sent down after her? It could not have been for the sake of either speed or safety; what if it should have been purely for the sake of *saving*, and nothing else?

Before concluding, I beg to tender my thanks to Mr. Voss, for his information as to the beating of the braggadocio *Castor* by the *Sirius*. Since then, I perceive, the advertisements of the French company are somewhat more measured in their language than they were wont to be, and that the "challenge" is silently withdrawn. So much for Gallic boasting! Query; if the slow-going *Sirius* found it so easy to beat her, what chance would she have stood with the *Great Western*, which left England a week after the *Sirius*, and reached New York the same day?

I remain, Sir,
Your very obedient servant,
OBSERVATOR.

July 23, 1839.

WOODEN PAVEMENT IN THE OLD BAILEY.

Sir,—Observing a number of blocks of wood laying in the Old Bailey, evidently prepared for forming a wooden pavement for the carriage way opposite the Session House, and finding the blocks to vary greatly in dimensions, I measured several of them, and found some eight inches and a half long, while others were nine inches and three-eighths; they are generally of the figure of a regular hexagonal prism—some of them, however, are a little conical, but the diameters vary so much, that it will be impracticable to fit them together without leaving interstices between them so great as to render the outer parts of the blocks liable to be chipped off by the feet of the horses and the wheels of the carriages passing over them.

The surface too of the ends of the blocks, each of which ought to be cut off exactly at right angles to the axis of the prisms, form, in many cases, oblique angles with that axis; and consequently, when the blocks are laid down, one side will be higher than the other, and thus the pavement will necessarily have an uneven surface, and much of the value of the wooden pavement be lost.

Having attentively watched for about four years, from 1827 to 1831, the effect of much travelling over a piece of wooden pavement, well executed in the principal gateway of Vienna, and observed that it appeared to wear away much less than any other kind of pavement, I frequently, after my return to England, mentioned to our engineers the superiority of this kind of pavement, and recommended its universal adoption.

But the goodness and durability will depend on the excellence of workmanship; the blocks ought all to be cut exactly to one gauge, and laid on an even bed.

I should consider a difference of a tenth of an inch in either length or breadth sufficient to disgrace any engineer who would permit such blocks to be laid down contiguously.

How great then must be my disgust at observing near an inch difference in the lengths, and more than an inch in the breaths of those blocks about to be used for the carriage-way in the Old Bailey.

Being thoroughly satisfied that neither comfort nor durability can possibly result from such excessively bad workmanship, and apprehensive that the numerous benefits and great economy of wooden pavements will, for a length of time, be lost to the community, if such a wretched specimen be allowed to influence public opinion, I deem it my duty to warn all those concerned against a proceeding which can only produce disappointment and public injury.

I am, Sir, your obedient servant,
JOHN ISAAC HAWKINS,
Civ. Eng. and Pat. Agent.

Quality-court, Chancery-lane.
London, July 24th, 1839.

PROGRESS OF MACHINERY AND MANUFACTURES ABROAD.

[*From Symons's Arts and Artizans at Home and Abroad.*]

Machinery is the main agent of manufactures, and no surer index of the progress of the latter can be adduced than the advances of the former. I am, I confess, not among the number of those who magnify the relative importance of the *existing* circumstances and extent of foreign competition; but I should be wilfully blind to the plainest evidences of the truth, were I to conceal that there are symptoms throughout the continent of a prospective, and by no means a remote rivalry with this country in the chief of those arts of production and elements of commerce in which England has heretofore maintained a perfect and facile pre-eminence. The peril to this country is to be measur d not by present competition, but by the magnitude of the preparations, and the germs of a progress which is, as yet, confined to a promising and vigorous infancy, evidenced chiefly by the rapid increase of machine making establishments, to a slight description of which I shall devote this chapter. Belgium, from her mineral riches and other topographical facilities, naturally takes the lead in the progress of continental machinery. I have already alluded to the Leviathan establishment of Mr John Cockerill, at Seraing, employing 3,000 workmen, with seven skilful English engineers, superintending the chief departments, and combining English skill with the advantage of cheap labour. The motive power consists of steam engines of 900 horse power; and Mr. Cockerill not only supplies machinery to all parts of the continent, but has branch establishments in three different countries. In addition to spinning machinery of every description, steam engines, both stationary and locomotive, are supplied to France,

Germany, and Russia. It is difficult to name any large enterprise of manufacturing industry, whether in Belgium, Holland, Russia, or the immense territory of the Prussian league, with which Mr. Cockerill is unconnected, either as a shareholder or as the engineer from whom the machinery emanates. He has spinning mills of flax, or cotton, or wool, in almost all the chief districts for these manufactures in the Prussian and Belgian dominions. Mr. Cockerill's name is on all the locomotive engines on the Belgian railroads, and I was told that he is the contractor for those now forming in Prussia. When we remember that Mr. Cockerill's father, who established this gigantic concern, came over to Belgium a common blacksmith, and could neither read nor write, I believe, till the day of his death; when we further consider that the machinery he turns out is, after all, of secondary reputation for quality, and extremely dear, we may form some idea of the power and magnitude of the natural advantages Belgium affords to the manufacture of machinery, and which may be reckoned as the multiplier of all her other productive powers. Mr. Cockerill, extensive as are his enterprises, by no means monopolises the making of machinery. Of those now commencing there are the Messrs. Fairburn, who have issued prospectuses of an establishment, which was to be formed at the large factory already built at Malines, near the railroad station. Mr. William Fairburn is to superintend the heavy department for engines, locomotives, &c., and Mr. Peter Fairburn that for spinning machinery, and especially for flax spinning. There can be no question that this establishment will rival any in England. In addition to these is the company of the Phœnix, at Gand, on a very large scale, and in which English and Scotch engineers are already engaged. There is likewise another at Brussels, of the existence of which some mystery is made. I owe the knowledge of it to Sir Hamilton Seymour, who kindly accompanied me to see it, and, owing to his good offices, we obtained the unusual favour of being allowed to inspect the interior. It is of large dimensions, covering two bonniers and a half, of about 6,500 square feet each. This establishment belongs to one of the *sociétés anonymes*, of which the Banque Nationale is said to be at the head. Five hundred workmen, of nearly all nations except France, whose operatives are not in repute in Belgium, are employed. Some of Sharp and Roberts's machinery was there. The present motive power is not above 36 horse. There are *several old-established machine makers in different towns in Belgium, but few on the same scale as those I have named.* The fact is, that this industry is yet in the first stage only of its development. Mr. Cockerill told Sir Hamilton Seymour that he had all the new inventions over at Seraing ten days after they came out in England. There is but one chance of an obstacle to the career of Belgium in her manufacturing progress of competition with England, and that one her Majesty's government have recently, no doubt with the best intentions, used their best exertions to remove—exertions which have met with the best reception and success on the part of Belgium. I allude to the decreasing stock and increasing price of coal in that country. The following table of its rapid rise in price is extracted from statistical government returns.

	1836.	1837.
Mons,	7 and 8 fr. per tonne	12 and 14 fr. ditto
Charleroi,	13 and 14 fr. do.	18 and 19 fr. ditto

Prior to 1836, Mons coal was 8 fr. per tonne at the *maximum*. It has risen in price again since last year; and the Belgian government have, consequently, assented to the prayer of the English government, to be allowed to supply them free of duty. By France a similar *boon* has been granted to the coal owners in England, and I need hardly say that the Belgian and French manufacturers are overjoyed at the concession. The iron works make equal progress in Belgium. In 1837 there were twenty-three high furnaces of coke, and sixty-six of charcoal, in Belgium. Twenty new furnaces of coke are either completed, or being erected since that period. On the plain of Selessin, near Liege, a company are erecting six, of a colossal magnitude, which, when finished, will be the largest on the continent. The quantity of iron founded in the year in Belgium was estimated at 150,000 *tonnes* (or about 147,640 English tons). It is now increased. The following are the current prices of iron per *tonne*.

	First quality.	Second quality.
1830	465 fr.	390 fr.
1832	412 fr.	322 fr.
1834	393 fr.	304 fr.
1836	413 fr.	324 fr.

In France, machine-making is proceeding with considerable rapidity. Mr. Dyer, of Manchester, has established his son at Blangy, not far from Abbeville, and there are many French competitors. There is one, especially, at Rheims, who turns out excellent machinery, and many at St. Etienne. At Zürich, in Switzerland, there is a first-rate establishment of this sort, where iron steam boats, down to the finest spinning machinery, are manufactured. There are nearly 700 workmen employed here, and seven are English foremen. Mr. Escher, who is one of the first and most scientific industrialists of the continent, is

at the head of this establishment, and, like Mr. Cockerill, is also the proprietor of several flourishing steam factories, some paper mills, some weaving, and some spinning mills, not only in Switzerland, but in Piedmont, Savoy, the Tyrol, and Wirtemberg, where he is about to erect a flax factory. Mr. Peter Kennedy, late of Manchester, is in partnership with him, and superintends the Austrian mills. New inventions are frequently made. For instance, I saw a roller introduced at the end of the carding frames, round which the cards are wound, and which dispenses entirely with the pans, and, consequently, with a great number of hands still employed in most, if not in all of the English mills. Again, they are enabled to unite the separate advantages of different patents in England; and at Mr. Escher's factory, in Zürich, I saw a combination of the self-acting mules severally produced by Sharp and Roberts, and Mr. Smith, of Deanston, and which their patents prevent our combining in England. Many of the foreign mechanics, who have not an equal skill, in the invention or improvements of machinery, directly pirate the productions of English skill. An English gentleman told me he had assisted in putting together some new machinery in Italy, which had been cast in moulds formed from some smuggled machinery of the Messrs. Crichton, with their name and the word 'Patent' cast on it. At Vienna, the Emperor has a large establishment under his immediate patronage, and an Englishman of the name of Thompson is one of his chief superintendents. The Emperor of Russia has very large foundries and spinning factories at Alexanderoffsky, with a General Clark at the head of the foundry, and a Mr. Wilson of the factories, and at Colpenny, with several English workmen. Wilson, brother of the above-named, is the foreman or superintendent at St. Petersburgh; the foundry is chiefly for cannon. John Isherwood, formerly of Leeds, is at the head of another establishment called Waybugskey, a part of the capital. The following information on the denizen mechanical skill in Poland is from a perfectly authentic source. A large mill, having sixteen pair of mill stones, moved by steam power, and lighted with gas, was erected at Warsaw some years ago. It was at first managed by a native of France, under whose management it did not succeed. For the last six years, a Mr. Kedslie, mill factor, from Leith, has been the superintendent, and he has taken out two millers and their families from the mills on the Water of Leith; the mill is now working day and night, and succeeding well. *All parties concerned there* are said to be much pleased that the bill to grind bonded grain has been thrown out by the British House of Commons. They fear nothing so much as British capital, machinery, and skill to compete with them. John Douglas and nephew, from Edinburgh, established thrashing machines and paper mills in Poland, and have now settled as paper mill proprietors in that country. Since the last rebellion in Poland, James Garvie and Son, also Thomas Garvie, shawl manufacturers from Edinburgh, have succeeded in establishing a shawl manufactory thirty miles from Warsaw, upon the estate of Count Lubenskie, President of the Board of Trade there: the factory consisted of thirty looms in the month of September, 1836. This same count has erected a spinning mill for flax, 300 feet long, 100 feet wide, three flats in height, and has 200 looms at work, weaving table cloths, towelling, and linens; also thirty shawl looms in the month of September, 1836. The yarn all spun by his own mill. Thomas Garvie has engaged to his overseer for the weaving department, and left the shawl factory to his brother James and Son, who are doing well. Mr. Prichard, from Edinburgh, now engineer to the government zinc mines in Poland, was in Scotland two years ago, at which time he engaged a bleacher from Perthshire who has commenced bleaching to the above establishment. This is the first attempt at bleaching in Poland. Mr. George Blackie, engineer, from Edinburgh, is now employed on canals and public roads by the government of Poland. At Prussian Bohemia, at Aix, in Prussia, and in Saxony, at Chemnitz, there are also machine making establishments. In fact, they are rising in all parts of the continent with a rapidity and to an extent very far disproportioned either to the growth of the population or to the progress of preceding years. English machinery is smuggled abroad in considerable quantities at a charge of seventy-five per cent., and sometimes for less. The increase of machine makers abroad, and the emigration of English artisans, will, however, soon tend, unfortunately for us, to diminish this traffic; for the very limited number of machine makers who have, till within the last two years, been established abroad, has hitherto tended to give them monopoly prices. Seeing the utter inefficiency of our laughable *prohibition* on the exportation of machinery, (driven by a screw of an inch and a half diameter,) it is much to be lamented that this protection and encouragement, afforded by the smugglers' high per centage, should be given to foreign machine makers, to the manifest injury of that branch of our own industry, without, in the slightest degree

benefiting the factories it is designed to protect. There are few absurdities of our custom house legislation which it is more urgently incumbent on the government to abolish. If a free exportation of foreign machinery were to take place, I have not the slightest doubt that the foreign machine makers would be crippled, and that we should largely increase our own trade in machinery—one, I may be permitted to remark, to which it is the policy of this country to give the fullest scope, as it is manifestly that in which we pre-eminently possess territorial and artistical capacity to excel, far surpassing that of any other nation. However, as long as we protect the machine maker abroad, to the injury of the machine maker at home, we must expect to see a rapid increase of this industry abroad; one, be it ever remembered, which is the prolific parent of every other; and, what is still worse, we must expect to see more of our Dyers, and Fairburns, and Cockerills preparing to follow their predecessors in transferring their skill and capital from the employment of home to foreign labour. I was debating the proposed imposition of a duty on our flax yarn by the French government, with one of the leading manufacturers of France, Mons. Delasalle, of Lille; "And how," said he, "can your government have the face to talk to us about the impolicy of protecting our home industry, when it goes to the ten-fold greater length of prohibiting even the exportation of the articles which may indirectly aid the industry of another country? Let England abolish her prohibition on the export of her machinery; let her abolish a protecting law of her own, more stringent and illiberal than that of any other nation in Europe, before she talks to us of the benefits of free trade." Mons. Delasalle is President of the Chamber of Commerce at Lille, and in constant communication with the government on these subjects. We had a very long discussion on the general policy of free trade. He adheres rigidly to the protective system, but not without many manifest misgivings in his own mind."

UPON THE ALLEGED INFLUENCE WHICH THE ROUGHNESS AND THE POLISH OF SURFACES EXERCISE UPON THE EMISSIVE POWER OF BODIES, IN REFERENCE TO THE EXPERIMENTS OF PROFESSOR SIR JOHN LESLIE. BY M. MELLONI.

When we measure the intensity of calorific radiation which takes place from the two sides of a metal vessel filled with boiling water, having the one of its longitudinal sides highly polished and brilliant, and the other, though at first polished, yet subsequently more or less streaked or furrowed with emery, or with the graver, or the file, we discover that the quantity of heat emitted by the streaked or unpolished surface, is always superior to that which emanates from the brilliant one. These variations sometimes exceed the ratio of two to one. Hence a deduction has been drawn, that the observed increase is owing to those inequalities which have been impressed upon the vessel, and that, consequently, the superficial asperities of bodies have the property of facilitating the exit of the heat which they contain. I beg the honour of communicating to the Academy the abstract of a series of researches, whence it seems decidedly to follow that this proposition is wholly erroneous; so that if the superficial layers clearly and decidedly contribute to make a difference in the quantity of heat emitted by a hot body, the state of the surface has no part in the production of this phenomenon.

First, I must avow that, in spite of the authority of great names, the influence of this polish in calorific emission, has always appeared to me very doubtful. It is said, the interior heat experiences in quitting the body the same action of the surface which it undergoes in penetrating it in the way of radiation. Be it so. But why should these small shining *facettes (facettes miroitantes) uniformly polished?* Take a vessel of copper, having two polished sides slightly obscured by exposure to the air: make with the graver on the one of these sides, a series of parallel furrows; the little furrows thus produced, will certainly be more brilliant than the rest of the vessel, and, notwithstanding, the furrowed surface will emit more heat than the smooth one. It is now nearly two years since I imparted this objection and some other experiments of the same sort, to Messrs. Bache, Henry, and Locke distinguished professors of physics from the United States, who were then in Paris. Now, however, that the question appears to me decided, I lay aside all indirect objections, and pass immediately to the exposition of results which conduce directly to the proof of the alleged fact.

I took a cubic vessel of copper, whose four faces were very carefully formed; externally I soldered on its lower angles and edges, grooves provided with springs, for the purpose of supporting firmly against the vessel plates of two or three lines in thickness; and having afterwards procured two pairs of plates, one pair of jet, and the other of ivory, I applied them to the four sides. Each pair was composed of plates in

every respect alike, except as it regarded the external surface, one of which was very smooth and brilliant, and the other was not polished, and was streaked with emery. On precisely measuring with the thermo-multiplier, the quantities of heat projected by the two polished faces, when the vessel was filled with hot water, and in comparing them with those which emanated from the corresponding streaked faces, I could only perceive differences to the extent of one or two hundredths (*centièmes*), and these sometimes on the one side and sometimes on the other. The mean of twenty observations yielded only a variation which scarcely amounted to a few thousandths (*millièmes*), and, consequently, might be altogether disregarded.

To this experiment it may perhaps be objected, that in spite of the precautions taken for the establishment of a perfect contact betwixt the plates and the vessel, we have nevertheless no certainty that the two plates which composed each of the pairs submitted to experiment, possessed the same temperature. To avoid this objection, I caused a square reservoir to be hollowed out of a small block of marble, the sides of which were reduced to a perfectly equal thickness, and the external surfaces of which were differently prepared. The first was smooth and brilliant; the second was equally smooth, but unpolished and tarnished; the third was streaked in one direction; and the fourth in two, crossed at right angles. The vessel was then filled with hot water, and *projected the same quantity of radiating caloric from each of the four sides.*

Hence, it appeared that the more or less irregular state of the surface has no influence upon the emissive power, when the radiating body is not of a metallic nature.

I then covered with lamp-black one of the faces of my marble vase, as well as one of each of the pairs of plates I had employed in the preceding experiment. As it has been agreed to represent by the number 100, the emissive power of lamp-black, I could easily determine, by successive comparisons, the proportional numbers which represented the emissive powers of ivory, jet, and marble. The whole three were found to be comprised between the numbers 93 and 98. But here might it not be said, that if in the substances which were thus employed, the influence of the unpolishing is nothing, this is owing to their emissive power reaching the limit of maximum, beyond which an augmentation can scarcely occur, because the emissive surface no longer supplies a hindrance to the escape of the heat; whilst in metals, far removed from this *limit, the alteration of* the state of the surface must necessarily exercise all its influence, and render it sensible by a marked variation in the quantity of caloric emitted?

Although this reasoning is based upon a pure hypothesis, viz. that lamp-black opposes no resistance to the radiation from the surface; and although the emissive powers of the three substances employed are indeed, on the one hand, so far removed from the number 100, as to permit us to appreciate the variations produced, and yet, on the other, are so energetic that the smallest proportion of change occurring in their values, would make them overcome the whole distance which separates them from this number; notwithstanding, let us for a moment abandon all these non metallic substances, and endeavour to determine the question from the bodies themselves with which we are now more especially concerned.

Copper, zinc, tin, and white iron, which so far as I know, are the only metals which have hitherto been employed in theexperiment described at the commencement, on being exposed to the action of the air, are quickly covered with a slight film of invisible oxide, the presence of which is deduced, in a very satisfactory manner, from certain electrical phenomena. Now, it is known that the emissive power is much stronger from oxides than from the metals themselves. It may happen then, that the streaked surface, presenting a greater number of points of contact to the air, is more oxidated than the polished surface, and thus augments its radiating power by the simple effect of oxidation, without the more or less regular arrangement of the superficial parts having any thing directly to do with the result.

For ascertaining if this explanation could be maintained, all that was required was to make the experiment with gold and platina, and this I speedily did; when I found that the streaked plates of platina and gold always yielded a much more abundant calorific emission than the polished surfaces of either metal.

Oxidation then, as well as the influence of *polish in non-metallic substances*, being put out of the question, the inquiry still remains, what is the alteration peculiar to metals which, in these bodies accompanies the change, more or less considerable, of the superficial layer?

It is no other, in my opinion, than a change of hardness or of density. Jet, ivory, and marble, are, in fact, substances which are almost entirely destitute of compressibility, or at all events they do not possess, in any sensible way, the property of permanently retaining the modifications of density and hardness impressed on them

by the action of mechanical force. They also readily arrange themselves in the form of plates without being subjected to pressure. On the contrary, the metals are compressible; and the common metal plates of commerce are obtained, as is known, by subjecting the metals to an extremely severe pressure by means of the hammer and screw. Finally, experiment also proves that these plates, as well as wires, have a specific-weight, and a hardness superior to those of cast metal. Who is the individual that will tell us, that this augmentation of hardness and density is uniformly distributed throughout every part of the mass? Is it not, on the contrary, probable that, during this operation, the surface undergoes a pressure and condensation greater than any other part; and that the plate is truly covered by a kind of envelope, whose density and hardness is superior to that of the internal layers?

This conceded, it is evident that by streaking the surface of a plate the less dense and hard parts will be exposed. Upon turning, then, to the tables which represent the emissive powers of bodies, it will be at once perceived that these powers follow, in general, the inverse ratio of their density. Let us admit that, according to all analogy, the same law holds regarding the different degrees of condensation of the same substance, and we may hence conclude, that, in producing these small furrows at the surface of the plate, we must obtain an augmentation of the radiating power. To this we have to add, that the parts which compose the superficial layer being loosened by the separation of their contiguous particles, must become softer, and thus acquire, by the diminution of density, an emissive power which will more nearly approach to the softer layers of the interior.

This being the case, it will result:—1st, that a polished plate of any given metal radiates a quantity of heat so much greater in proportion as the density or the hardness of its superficial layers is less; and, 2nd, that in the case of inferior density and hardness, the increase of the radiating power produced by the *un*polishing will be inferior to that obtained when the plate is denser and more thoroughly compressed.

It is almost unnecessary to add, that, for the verification of these theoretic conclusions, we must avoid employing a metal which is oxidated at a low temperature, for a plate of metal of this kind is imbued with a tendency to augment its emissive power, which varies every moment with the condition of the superficial layers, and so much the more as these layers are soft and detached. Violent percussion, on the one hand, and a very slow transition from the state of fusion to solidity, on the other, are the two means by which we succeed in endowing metallic substances with greater or less degrees of density. Accordingly, I ordered two pairs of plates to be made of very pure silver, and gave directions that one of each pair should be hammered to a high degree, and the other should be cooled down very slowly in its sandy mould. Out of these I constructed, with the addition of a metallic bottom, a small rectangular cistern, the sides of which were united by means of soft solder, so that there might be no risk of altering their densities or tempers, during the operation. When so united, the four sides were perfectly polished, which process had been accomplished by means of pumice-powder and charcoal, without the help of either the hammer or the burnisher. I then took coarse emery paper, and strongly rubbed, in one direction, one of each pair of the plates; the images of objects which appeared very distinct and bright upon the surfaces which were left in all their pristine polish were completely effaced upon the rubbed surfaces, which were quite obscure and covered with striæ. The vase, thus prepared, was filled with hot water; and the four sides, successively presented to the opening of my thermo-electrical apparatus, produced the following effects upon the galvanometer:—

The forged and polished plate, .. 10°
The forged and roughened plate, . 18°
The cast and polished plate, ... 13°7
The cast and roughened plate .. 11°3

In comparing these four radiations, we perceive, 1st, as to the *polished* plates, that the cast metal affords nearly one-third more than the forged metal; which most clearly demonstrates the influence we have assigned to the inferior density; and, 2nd, that the effects of the streaking upon the two sorts of plates differs not only in intensity, as we had foreseen, but also in *kind*, for if the radiating power of the forged plate received an *augmentation* of four-fifths by the roughening action of the emery, on the other hand, that of the cast silver experienced a *diminution* of nearly one-fifth.

This unexpected result, which irrefragably proves the truth of our fundamental proposition, is most satisfactorily explained by the theory we have just been developing. For the pressure of a hard body, such as the emery, upon the soft surface of the cast metal, somewhat compresses and condenses the rubbed parts, and makes the bottom of the striæ, produced upon the superficial layer, harder than the whole surface of the corresponding plate.

I have to regret that I had not an opportunity of making the same experiment upon

vessels of gold and platina, where the same kind of manifestations, in all probability, would exhibit themselves upon a larger scale, on account of the very great difference of density we can impart to these metals by means of fusion and percussion.

And now, turning to the first observations of the late Professor Leslie, we observe that the different metallic plates which he subjected to experiment, gave constantly a greater emissive power when they were rough and irregular, than when they were smooth and polished. This being the case, nothing appeared more natural than to conclude, regarding the phenomena of the emission of caloric, that, apart from the influence dependent upon the quality of the superficial layers, there was some peculiar influence dependent upon their degree of polish, so far at least as the metals were concerned. This was the conclusion drawn from the facts observed by Mr. Leslie; and, notwithstanding this conclusion—so simple and direct in appearance, was unwarrantable.

Here, then, is a beacon where needed, against the unfortunate precipitancy with which some experimenters hasten to dignify as general laws, the consequences which result from their first experiments. Sometimes, we have only to take up an instrument and use it in some research, in order to stumble upon some new fact. But in prosecuting the work with becoming assiduity, in varying our modes of experimenting, and in analyzing the phenomena in different aspects, it will most generally be found, either that the novelty is only apparent, and that the true explanation may be found among the already established truths of science; or if, on the other hand, it turns out to be a real discovery, it will almost invariably contradict those alleged general laws which first of all presented themselves to our minds with so much apparent certainty and clearness.—*Comptes Rendus de l' Académie des Sciences.—Edin. Phil. Journal Translation.*

BETHELL'S PATENT METHOD OF RENDERING WOOD MORE DURABLE, LESS PERVIOUS TO WATER, &c.

Mr. Bethell has circulated the following account of his lately patented improvements in preparing wood, so as to render it more durable, less pervious to water, &c. They are founded upon the supposition that the mere external application of any solution or mixture, either by steeping, painting, &c., &c., never can be effective in preserving wood from decay, as the first symptoms of *dry rot* are generally to be discovered in the *heart of the timber, where* the sap being untouched by the solution, ferments and putrifies, if the wood be placed in a moist and warm situation.

The view which he has taken has been strongly supported by Sir John Barrow, Secretary to the Admiralty, who, in his "Life of Lord Anson," lately published, when speaking of the different modes of preserving wood that have hitherto been suggested, observes, "The steeping of large logs of timber in solutions of any kind is *perfectly useless*, the solution penetrates *only skin deep*, whereas the real dry rot commences at the centre, where the fibres, being the oldest, first give way, as is the case in the standing tree."

Mr. Bethell's process consists in a mode of impregnating the wood to the centre, and saturating it throughout its whole substance with various solutions and mixtures, which have the effect of *coagulating the sap*, and thus preventing its putrefaction. But for wood that will be much exposed to the weather, and alternately wet and dry, the mere coagulation of the sap is not sufficient, for although the albumen contained in the sap of wood is the most liable and the first to putrify, yet the ligneous fibre itself, after it has been deprived of all sap, will, when exposed in a warm damp situation, rot and crumble into dust. To preserve wood, therefore, that will be much exposed to the weather, or to a warm and damp situation, it is not only necessary that *the sap should be coagulated, but that the fibres should be protected from moisture.* This Mr. Bethell effects by impregnating the wood throughout its whole substance with oil of creosote mixed with tarry bituminous matters. The creosote coagulates the albumen, and the tarry and bituminous matters fill up every pore, and form an insoluble waterproof covering to the fibres of the wood.

The preserving power of creosote has been well known to chemists for many years, and has been proved to be the chief preservative used by the Egyptians in preparing the mummies, as has been clearly stated by Dr. Robert Dickson, in a lecture on the dry rot, delivered by him before the Institute of the British Architects, on the 3d April, 1837, and published by the "Anti-Dry-Rot Company," from which the following is an extract:—

"The ancient Egyptians, whether from the peculiarity of their religious opinions, or from the desire so natural to the human heart to shun destruction, and gain perpetuity even for our dead bodies, prepared the corpses of their deceased friends in a particular way, and how perfectly this has preserved them, the occasional opening of a mummy permits us to see. The secret of this appears

to be, independent of the careful exclusions of air, in the use of means to *coagulate the albumen* of the various fluids of the body. What the agent was which they employed to effect this, we now know very well; it was *creosote*, a principle which modern chemistry has isolated from its combinations.

"*Creosote* is now extensively employed for the preservation of animal structures for anatomical purposes, as it coagulates the albumen, besides being the principle by which smoke-dried meat is preserved. Lest these analogies should not appear satisfactory, we may appeal to the wood found in a state of preservation in the bogs of Ireland and Scotland, Yorkshire, &c. Professor Don informed me that he has found, in the Irish bogs, at the depth of eighteen feet under the surface, cones of the Scotch fir *(Pinus Sylvestris)* in an entire and perfect condition. Now, as the Scotch fir is not, in the present day, a native of Ireland, these cones must have been produced many centuries ago, and owe their preservation, as well as that of the wood, in addition to the exclusion of air, to the *creosote existing in the bogs, which, penetrating their tissues, coagulated the albumen, and rendered them insusceptible of decay. The principle, then, thus appears to have stood the test of ages, whether applied by the hand of nature or of man.*"—See pages 20, 21.

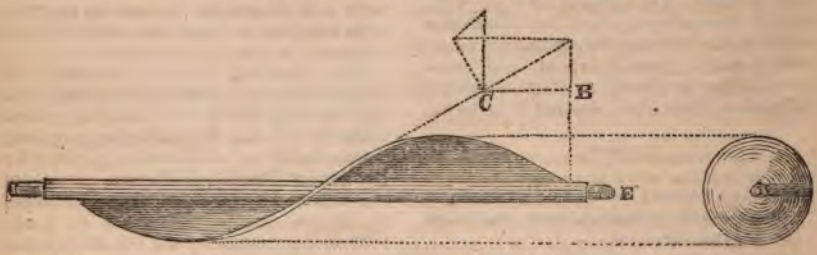
By Mr. Bethell's process (it is stated), large logs of timber are impregnated to the *centre*, and saturated throughout their whole substance with this creosote, which has stood the "test of ages" as a valuable preservative.

Timber thus prepared becomes nearly *waterproof*, which alone would render it more durable, even if it were not impregnated with "creosote."

The atmospheric action on wood so prepared, renders it tougher and *infinitely stronger*. A post made of *beech* is rendered more durable, and as strong as one made of the best *oak;* the bituminous mixture with which all its pores are filled acting as a cement, to bind the fibres together in a close tough mass; and the more porous the wood is, the more durable and tough it becomes, as it imbibes a greater quantity of the bituminous mixture, which is proved by its increased weight—a cube foot of beech weighing nearly 8 lbs. heavier after it is prepared than before. The mixtures which are injected preserve iron and metals from corrosion; and an iron bolt driven into wood so saturated, remains perfectly sound and free from rust. It also resists the attacks of insects, and as far as experiments have been hitherto made, it has appeared that the teredo navalis will not touch the wood impregnated with this mixture, although it destroys timber prepared with corrosive sublimate, as has been lately proved at Sheerness.

Wood thus prepared for sleepers, piles, posts, fencing, &c., is not at all affected by alternate exposure to wet and dry; it requires no painting, and after it has been exposed to the air for some days, it loses every unpleasant smell.

FORMULÆ FOR CALCULATING POWER OF SCREW PROPELLERS.



At the request of several correspondents, we publish Tredgold's formula for calculating the power of the screw as a propeller of bodies through water, to which we referred in our account of Mr. Smith's patent screw in Number 830. We take it from Mr. Weale's new edition of "Tredgold on the *Steam Engine,*" from which we also extract *the formula upon the same subject* by (we *presume) the editor, Mr. Woolhouse*:—

"*Of the Spiral Propeller, or Water Screw.*—The acting portion is a spiral surface projecting from a cylindrical axis; and, in order that it may be at all effective, each point in the surface must revolve so rapidly, that the motion of that point in the direction of the axis must be greater than that of the vessel. Also if the angle of the spiral to the axis be constant, it is obvious that, by having more than one revolution, the rest

add little to the effect, perhaps not equivalent to the additional friction. Let B A C $= a$ be the angle which the screw forms with a line A B perpendicular to its axis; then during the time the boat would move from C to B, a point in the surface must move from B to A, otherwise it would retard the boat; and, in order that it may be effective, it must move at some greater velocity. But the velocity of the boat, v, is to that of a point in the surface when no effect is produced, as B C : A B : : v. $\frac{\text{A B}.\ v}{\text{B C}} = \frac{v}{\tan. a}$.

Hence the actual effective velocity,

$$\text{V} - \frac{v}{\tan. a} = \frac{\text{V} \tan. a - v}{\tan. a}.$$

Let x be the variable radius of the cylinder; then $\frac{2 \pi x}{\cos. a}$ = the length of the spiral, and $\frac{2 \pi x\, dx}{\cos. a}$ = the differential of its area. Its resistance is therefore

$$\frac{\pi (\text{V} \tan. a - v)^2 (\sin. a^3 + \sin. a^2)\, x\, dx}{\cos. a \tan.^2 a}$$

when the vessel is at rest; and when it is in motion it increases in the ratio of $\frac{\text{V} \tan. a - v}{\tan. a} : v.$; hence, πv (V tan. $a - v$) 2 sin.$^2 a$ + sin. a) = the resistance.

This resistance is to the effect to impel the boat, as the radius is to tan. a; hence, $\frac{1}{2} \pi x^2 v$ (V tan. $a - v$)^2 (2 sin. a^2 + sin. a) tan. a = the force; and $\frac{1}{2} \pi x^2 v^2$ (V tan. $a - v$) (2 sin.$^2 a$ + sin. a) tan. a = the effect, which should be equal to the resistance of the vessel.

It is a maximum when v^2 (V tan. $a - v$) $= a$ max.: that is when $\text{V} = \frac{3 v}{2 \tan. a}$.

Hence the effect at the maximum is $\frac{1}{4} \pi x^2 v^3$ (2 sin.$^2 a$ + sin. a) tan. a.

But the power to produce it must be $\frac{3 \pi x^2 v^3 (2 \sin.^2 a + \sin. a)}{8}$, its velocity being V. Consequently, when tan. $a = 1$, the power is to the effect as 3 to 2, as in the ordinary paddle-wheel; but if tan. $a = 1.5$, the power and effect are equal: on the contrary, if tan. $a = .5$, or the angle C A B is about 26°, the power is to the effect as 3 : 1.

"Now, a little more than one revolution of the spiral would produce this effect, and a second revolution at the same angle could have very little action, because the water would have acquired all the velocity the spiral could communicate. If it be continued, it should therefore be made with a decreasing angle.

"In practice the size corresponding *to these effects is everything*; our next object must therefore be to ascertain it. Taking an angle of 60° for the angle C A B, tan. $a = 1.732$, and sin. $a = 866$, the effect is in this case, $\frac{1.732}{4} \pi x^2 (2 \times .866^2 + .866) =$ $0.73 \pi x^2$; but πx^2 is the area of the end of the cylinder, therefore each foot of surface of the end of the cylinder will act with a force of 0.73 lbs. for one foot per second. The length of the cylinder would be $2 \pi x$ tan. $a = 10.8$ times its radius, or 5.4 times its diameter. The power required for this effect is, $\frac{3 \pi x^2 (2 \times .866^2 + .866)}{8} =$ $.887 \pi x^2$, or 0.887 lbs. for each foot of area of the end of the cylinder, for one foot per second.

"When $a = 40°$, the effective force is only 0.4368 lbs. per foot, and the power to each foot must be .64 lbs.; the power therefore decreases nearly in the same ratio as the length.

"These calculations are sufficient to show that this method may be used with considerable advantage, the action being under water, and the projection from the side being not so great as paddle-wheels; while the smoothness and the uniformity of the motion are circumstances much in its favour.

"On the other hand, the mode of communicating motion and the resistance the parts will offer that are applied for that purpose, are objections; for the present I shall therefore content myself with recommending it to the notice of my readers."

Formulæ (by Mr. Woolhouse) for calculating the effects of the Screw Propeller, when applied to Steam Vessels.

"r = the radius of the screw in feet.

h = the pitch also in feet.

π = 3.14159 log. π = 0.49715.

$c = \frac{w}{2 g} \frac{\pi}{550}$. log c = 7.75506.

$k = \frac{h}{2 \pi}$ log. 2π = 0.79818.

v = the velocity of the vessel in feet per second, or the velocity in miles per hour multiplied into $\frac{22}{15}$.

u = the velocity of a point in the screw at the distance.

k from the axis.

S = the effective resisting surface of the vessel.

$$\text{A} = k^2 \left\{ \frac{r^2}{k^2} \text{ hyp. log. } \left(1 + \frac{r^2}{k^2} \right) \right\}.$$

$$u = v \left(1 + \sqrt{\frac{\text{S}}{\pi \text{ A}}} \right).$$

Number of revolutions per second = $\frac{u}{r}$

"Horse power of engine $= c\,A\,(u-v)^2.\,u.$

"Horse power effective $= c\,A\,(u-v)^2.\,v.$

"In the absence of better information, the value of S may be roughly estimated at about one-fifth or one-sixth of (tonnage) $\frac{2}{3}$, according to the construction of the vessel. The larger the diameter and the less the pitch of the screw, the greater will be the proportion of effective power on the vessel."

ROYAL OBSERVATORY, GREENWICH.

Since the appointment, two or three years ago, of a Board of Visitors to superintend this establishment, and of Professor Airy to be the Astronomer Royal, the numerous reforms of which it stood notoriously in need, have been prosecuted with great spirit and determination; and there seems now every prospect of its soon becoming all that the most ardent lovers of astronomical science can desire.

The periodical meetings of the board continue to be extremely well attended; at the last meeting, in June, there were present, the Duke of Sussex, the Marquis of Northampton, Sir John Herschell, Davies Gilbert, Esq., Dr. Pearson, Dr. Gregory, Captains Beaufort and Smith, Professors Challis and Johnson, Messrs. Baily, Babbage, and Lubbock. A very interesting report was read on this occasion by the Astronomer Royal, a copy of which we have the pleasure to subjoin.

Report.

I beg leave to lay before the Board of Visitors the following Report, on the general concerns of the Royal Observatory, and the business which has been transacted there since their last meeting. In the general arrangement of this Report, I shall follow the same plan as in the Reports which I have had the honour to lay before the Board in the last three years.

1. Grounds and Buildings.—At the last meeting of the board, I suggested the advantage of inclosing and fitting up the room, known by the name of the Second Quadrant Room (being the western portion of the room known in Bradley's and Maskelyne's time as the Quadrant Room), in such a manner as to render it a safe room for the deposit of manuscripts, and other valuable articles. The suggestion having been approved by this board, and having been laid before the Lords Commissioners of the Admiralty, was by them immediately referred to their civil architect for plans and estimates. The Lords of the Admiralty having in the last summer personally inspected the observatory, and having been struck with the inconvenience arising from the want of an inclosed communication between the observatory and the dwelling-house of the astronomer-royal, were pleased to suggest that a covered passage should be constructed at the same time as the inclosing of the Muniment Room. The financial arrangements of the government prevented any steps from being taken until the estimates for the present year should have been sanctioned by Parliament. Since that time, the plans and specifications for the various parts of the work have been placed in the hands of the builders, and I have every reason to think that the work will be proceeded with in a very short time.

One side of the proposed room will be formed by the pier carrying (on that side) Grahams's Quadrant and the fixed Telescope erected for the observations of α Cygni. I have thought it desirable to remove the fixed telescope, but to retain the venerable quadrant in its place, and even to put it in such order that, if any future astronomical antiquary should desire, observations may be made with it. The room is to be covered with arches of brick-work; but by leaving vacant a part at the end of one of these arches, and by covering it with a flat stone, which can be removed with little trouble, the command of the northern opening will be given to the quadrant telescope. The iron-work of the quadrant had formerly been painted; but it had, from neglect, suffered materially from rust. I have caused it to be cleaned and painted, under the personal inspection of Mr. Simms: and the limb and verniers, with other small parts, were carefully cleaned at the same time. I may remark that the object-glass appears to be achromatic: I know not whether there appears in the publications of the observatory any memorandum of the time when this object glass was inserted.

The board are aware that a meridian mark (a pillar of granite) was erected under the direction of Mr. Pond, in the year 1824, at Chingford in Essex, upon one of the hills projecting from Epping Forest, on a piece of ground leased to the Board of Admiralty for ninety-nine years from that time. Although this mark is not used by me in the same manner as by Mr. Pond, in the occasional adjustments of the transit, yet I am fully aware of the advantage of keeping it in repair, and sometimes observing it, for the purpose (if there were no other) of noting the direction of a line of several miles in length, which in 1824 was as nearly in the meridian as it could be placed by the best

instruments in the world. Some small steps have therefore been taken by me for the preservation of the fence, &c.; and I propose to regard it as an object whose careful conservation is well worthy of attention.

Nothing else has occurred in regard to the buildings and grounds, which seems to call for the least remark.

2. Moveable Property.—I have before expressed my intention of causing the whole of the moveable property of this institution to be carefully marked and accurately catalogued. I have not yet found the leisure necessary for that purpose: but I propose to take this work in hand as soon as the arrangement of manuscripts shall be completed.

No alteration worthy of remark has occurred in the moveable property, excepting in the class of instruments, of which I shall speak hereafter.

3. Manuscripts.—In my last report to the board, I intimated that it was necessary, before commencing any arrangement of the manuscripts, to divide many of the books into two or more parts each. This was rendered necessary by a practice sometimes followed in Mr. Pond's time, of taking books which had been only partially filled by Dr. Maskelyne, and inserting in the blank leaves calculations of a different date, and (sometimes) on very different subjects. The separation of these parts having been nearly completed, I have been able to proceed with the first step towards arrangement, namely, the marking on the outside of each book the whole of the contents of its interior. From the confused state of some of Dr. Maskelyne's books, this has, sometimes, been a task of much trouble. I need not observe, that it was quite necessary for me to undertake myself the whole of this work: and this is the principal cause of the delay that has occurred. I am, however, extremely glad that I have thus been compelled to become acquainted with the system and general practice of my predecessors: and my estimation of their judgment and order, as well as of their industry, has been greatly raised. During the whole, or nearly the whole of Dr. Maskelyne's time, the daily observations of stars are reduced in ledger, and the solstices and equinoxes of each year are discussed, with as great regularity as at the present time: and the same is done with equal regularity, and on a more extended scale, through Mr. Pond's time. The observations of the sun and planets, but more particularly those of the moon, are, through a great part of Dr. Maskelyne's time, most laboriously compared with the existing tables, and special investigations are *founded on them for the* improvement of particular points of the tables. The computations last mentioned probably belonged rather to the board of longitude than the Royal Observatory. The impression which the perusal of these papers has left on my mind is, that from these the true state of the heavens—as regards the main points of the sun's path, the moon's path, and the places of the fundamental stars—may be gathered more accurately and more certainly than from any system of interpolation like that pursued by the illustrious author of the Tabulæ Regiomontanæ. I cannot but regret, that the intermediate steps between the unreduced observations and final catalogues were not made public: and I am more than ever persuaded of the importance of that course which I have followed since the Cambridge Observatory was first placed under my direction, of publishing the reduced result of every individual observation, with as many of the intermediate steps as are necessary to enable any one with facility to recompute the whole.

4. Library. — No addition particularly worthy of notice has been made to the library: although, by the gradual supply of the principal astronomical works of real value, it is (I hope) kept up to the present state of the science.

5. Instruments.—In the report of 1838, I called the attention of the board to the state of the divisions on the declination circle of the Shuckburgh equatorial. The representation which in consequence was made by this board to the Lords of the Admiralty received their lordship's immediate attention, and Mr. Simms was directed to redivide the circle. This has been done, and (so far as I am able to state) in the most satisfactory manner. Several small repairs were at the same time made to it, where from long exposure to the atmosphere the brass-work had absolutely decayed.

The equatorial mounting (including clock-work) for the Sheepshanks telescope was received late in the last summer from Mr. Grubb, and, though inconvenient, appears to answer very well. Some trifling matters in the mounting, suggesting themselves experimentally, step by step, are hardly completed at the present time. The power and general goodness of this telescope make it a most valuable addition to the instruments of the observatory. It was used last autumn in the observations of Encke's comet.

In the summer of last year I had commenced arrangements for the mounting of one of Gauss's bifilar magnetometers. But a course of experiments undertaken at the request of the Board of Admiralty, for the

correction of the compass in iron-built ships, compelled me to dismount the whole of the magnetical apparatus: and since that time I have not been sufficiently at leisure to restore the bifilar magnetometer to an effective state.

The great inconvenience, occasioned by the irregularity of the center-work and the inequality of divisions of the cape mural circle, has long been known, but no expedient had till lately been proposed for correcting it without impeding the course of current observations. It was at length suggested by one of the members of this board, that, if one of the circles could be spared from this observatory, it might be sent to the Cape and mounted there, while the defective circle should be returned to England for repair. Being myself satisfied with this proposal, and having ascertained from several members of the board that no objection occurred to them, I lost no time in communicating it to the Board of Admiralty; and, by their lordship's command, Jones's circle has since been shipped for the Cape. The observations are continued with Troughton's circle, on the same plan as that which I pursued with the mural circle at the Cambridge Observatory.

6. Observations.—The first place in importance has been given to the regular meridional observations of the principal stars, and the sun, moon, and planets. But besides these, the following objects have been observed. γ Draconis has been regularly observed with the zenith tube. Observations have been continued on the stars observed at Cambridge with Halley's comet—on low stars intended, by comparison with observations at the Cape of Good Hope, to give information on the subject of refractions—on stars pointed out by Mr. Baily, as requiring observation—on stars observed by Colonel Colby with Ramsden's zenith sector—on stars observed, in conjunction with Mr. Sheepshanks, for the longitude of Antwerp—on stars observed with Mars (by the equatorial) at the last opposition—on stars whose occultations have been observed—and on μ and θ Cassiopeiæ throughout the year 1838. With the equatorials, Jupiter was compared with χ Leonis, Encke's comet with small neighbouring stars, Mars with the stars inserted in the Ephemeris of the Nautical Almanac, and lately Venus with ε Geminorum. Occultations of stars by the moon, and eclipses, occultations, &c. of Jupiter's satellites have also been observed. Meteorological observations have been made at the times recommended by Sir John *Herschel, and observations of the meridional magnetic needle at every 5 minutes through 24 hours on the days (Feb. 22 and May 24) appointed by Gauss.*

7. Reductions.—The reductions for the year 1838 are not at present so forward as those for 1837 were at the last meeting of the board. An accurate account of the state of reductions may be derived from the last weekly report (now exhibited), or from inspection of the computations in the printed skeleton forms. The general state of reductions may be described as follows:—The observations, both with the transits and with the circles, are completely reduced to September last, and partially reduced to the end of the year. The results, as far as possible, have been collected in ledger, but no means, &c., can be taken until the observations of the whole year are finished. The reductions of the equatorial observations are very nearly complete. The reductions of the observations with the zenith tube and of the occultations are not commenced.

8. Printing.—The state of the printing will be inferred from the proof sheets now laid on the table. It is nearly as forward as the state of the reductions allows it to be brought.

It will be perceived from the statements just made, that our reductions do not keep pace with our observations. This has arisen, partly from general and partly from special causes. The general causes are, the increased extent of calculations and care in the execution of them, and the increased amount of printing. With regard to the extent of calculations, the members of the board have, in their hands, the means of forming a judgment, With regard to the care in making the calculations, it may be sufficient to state, that every entry of an observation and every calculation made by one person is regularly examined by another, and that all results are irregularly examined by myself or by the first assistant. With regard to the amount of printing, the volume for 1836 contained about fifty sheets more than it would have contained if printed on the system formerly adopted by Mr. Pond, or about forty-three sheets more than if printed like the later volumes of Mr. Pond's observations. As the reading of each sheet employs, on the average, two assistants for about two mornings, it will be seen that two hundred additional days' works are employed on reading the proof sheets only. How much more time is consumed in preparing the sheets for the press I cannot estimate. These may be considered as general causes. The special causes are, the introduction of the magnetical observations, which (even as far as they have gone) have consumed much time; the occupation of my own time by business connected with the reduction of the former lunar and planetary observations, and with inquiries relative to standards of weight and

measure; the occupation of my own time, and (partly) that of the assistants, in the experiments made last year for the correction of the compass in iron ships; and the occupation of the first assistant's time in the examination of bars for the survey at the Cape of Good Hope. I ought not to omit that, though much of the chronometer-business, which withered the power of the establishment during Mr. Pond's presidency, has been removed, still the daily comparison and regular report of numerous chronometers (seldom so few as forty), occupying two assistants for about two days in each week, are no inconsiderable retardation of the business of the observatory. These causes appear amply sufficient to explain why our reductions can hardly be kept up to our observations. I do not, however, wish at present to call on this board for additional assistance. After the experience of another year I shall probably be able to state more distinctly, whether in my judgment a greater force of computers is necessary in the observatory.

G. B. AIRY.

June 1, 1839.

OPTICAL GLASSES OF THE LATE DR. RITCHIE.

At the meeting of the Astronomical Society on the 14th ult., Mr. Simms, the well-known optician, read a paper upon this subject. He stated that as some interest is felt respecting the optical glass of the late Dr. Ritchie, his object is to communicate to the Society such particulars respecting it, as his experiments have enabled him to collect. Besides several pieces of very excellent crown, Mr. Simms obtained twenty-nine discs of flint glass, varying in diameter from 4 to 7½ or 8 inches. These were circular, and had evidently been cast in a mould; in thickness they varied exceedingly, some being scarcely thick enough for the purpose for which they were intended; and others at least three times as thick as necessary. Of these twenty-nine discs, only three give promise of being fit for telescopes at all; two of 4, and one of 4½ inches diameter; and even these not likely to prove of the first order. The rest are, literally full of veins and striæ, and the bestowal of any labour on them would obviously end in loss and disappointment. The results of a series of comparative experiments are stated in the following table, in which the refractive and dispersive powers, for the lines of the spectrum distinguished by Fraunhofer as B and G, are pretty accurately given for the four specimens of flint-glass that were examined. The first is of glass, made by Guinand, of Neuchâtel; the second was made several years since, at the Stangate Glass-works, near Lambeth; the third, by Dr. Richie; and the fourth, at the Falcon Glass-house, Whitefriars; and it will be seen that in all those qualities which were made the subject of investigation, the flint-gass of Dr. Ritchie differs little if at all, from that which is generally made in England. The fact, however, of a disc of flint-glass, 7½ inches in diameter, having been made sufficiently perfect for the construction of a good achromatic telescope, is unique in the history of glass-making in this country.

Flint Glass.	Specific Gravity.	Index of Refraction for B.	Index of Refraction for G.	Dispersive Power B. to G.
Guinand	3.6459	1.616	1.644	.044
Stangate	3.3747	1.594	1.619	.041
Ritchie	3.2269	1.573	1.597	.041
Falcon..	3.1964	1.570	1.593	.039

MISCELLANEOUS FACTS AS TO STEAM-ENGINES IN THE UNITED STATES.

[From the Report of Mr. Levi Woodbury to the Congress of the United States, on Steam-engines, and Steam-boats. Dec. 1838.]

Since the employment of steam-boats in the United States, it is computed that quite 1,300 have been built there. Of these, about 260 have been lost by various accidents, as many as 240 worn out, and the rest are now running.

The first steam-boat used for practical purposes here (or indeed in any part of the world*) was in 1807, on the Hudson river, in the state of New York. She was built by Fulton, called *the North River*, with an engine of only 18-horse power, and made the passage between Albany and New York in 33 hours. Though with a steam-engine manufactured abroad by Boulton and Watt, yet no boat was launched in Europe, that proved successful in practice, till five years after by Mr. Bell at Glasgow, in 1812. At that time, the *Car of Neptune*, built in 1808, the *Paragon*, in 1811, and the *Richmond*, in 1812, were all, in addition to the boat first built, running from New York. Rumney is known to have made experiments on a small scale as to steam-boats in Virginia, as early as A.D. 1787; but they were not reduced to any practical use. Both he and Fitch commenced trials in this country as early as 1783 and 1784, and Oliver Evans in 1785

* Not so. Symington's claims to this honour have been so repeatedly and so completely established, that we need only now mention his name in contradiction of this assertion. See particulars Mech. Mag. vol. xix, p. 121.—ED. M. M.

and 1786. They had been preceded in France, in 1792, by the Marquis d'Jeaffrey, and the idea of applying steam in boats had been suggested in England as early as 1736, by Jonathan Hulls.

The whole number of steam-boats ascertained and estimated to be now in this country is 800. In England, in 1836, the whole number is computed to have been 600. On the western and south-western waters alone, near 400 are now supposed to be running, where none were used until 1811, and where, in 1834, the number was computed to be only 234. Of these 400, about 141 are estimated. On the Ohio river alone, in A. D. 1837, about 413 different steamboats are reported to have passed through the Louisville and Portland canal, besides all below and above, which never passed through. But it deserves notice, that of those 413, near 60 went out of use by accidents, decay, &c. within that year; and several of the others, viz.: 104, were new, and many of them, probably, were destined to run on other rivers. As an illustration of the rapid increase of business in steamboats on the Ohio, the number of passengers by them through the Louisville canal increased from 406, in A.D. 1831, to 1,501, in A. D. 1837, or nearly fourfold in six years. About 70 boats were running, the present year, on the north-western lakes, where, a few years since, the number was very small, having been in 1835 only 25. Of the 800 steam boats now in the United States, the greatest number ascertained to be in any State is 140, in the State of New York.

It is a matter of surprise that so few of these are sea-going vessels, considering that the first steam-boat which ever crossed the Atlantic was built in New York, as long ago as 1819; and went from Savannah (the place after which she was called) to Liverpool in 26 days; and that the *Robert Fulton*, as early as 1822, made several trips to New Orleans and Havana. A similar remark applies to the circumstance that only one of the whole number is a public vessel of war, when the first steam-vessel of that kind ever launched was the *Fulton*, and was built in this country as long ago as A.D. 1815. The government of the United States never owned but two steam-vessels of war—both called the *Fulton*. The first one was lost by accident in 1829; and now there is only the other, before alluded to, built in 1838. It has, however, 13 other steam-vessels, employed by the War Department on the public works, and in transportation of troops and stores.

Of the whole number of locomotives in the United States propelled by steam being about 350, the most which have been ascertained in any State is 96, in the State of Pennsylvania.

None of them were introduced here till A.D. 1831, though they now run on nearly 1,500 miles of railroad. The first one, it is believed, was in the State of Delaware, on the Newcastle-railroad; the second in Maryland, on the Baltimore and Ohio railroad; and the third between New Orleans and Lake Pontchartrain, in the State of Louisiana. They had been tried in this country by Oliver Evans, as early as 1804, and in England as early as 1805; but not reduced to useful practice in the latter till 1811, for freight, and in A.D. 1830, for passengers and speed. One succeeded on a common road, from London to Bath in 1829.

Of the whole number of other steam-machines in the United States (being about 1,860) the State of Pennsylvania has the most ascertained, being 383. The number in some States is not accurately ascertained; but near 300 more are ascertained and computed to exist in Louisiana alone. The introduction of them here, and especially with the high-pressure machinery, was much promoted by Oliver Evans about A.D. 1804. The first of them in use in the United States was in A.D. 1787, in the State of New Jersey, for raising water and earth from mines. The next were about 1791, in a cotton-factory at Kensington, near Philadelphia; and soon after in saw-mills, and iron slitting and rolling-mills at Pittsburg. The power has been known in England to be applicable to mechanical uses, since the experiments of the Marquis of Worcester in 1563. It is claimed by some that he was preceded in France (and a pamphlet published on the subject as early as 1615) by Solomon de Caus. But the views of the latter, like many who preceded even him in the knowledge of steam as a moving power, are supposed to have been rather theoretical than practical. Several machines were made in England as early as 1720; and Watt's first patent was taken out for improvements in them as early as 1769. But they were not, even there, very extensively and successfully applied to mills and manufactories till 1785, though 18 large engines were employed in the mines of Cornwall as early as A.D. 1770; and a flour-mill with 20 pairs of stones was moved by steam in London in A.D. 1784.

The greatest employment of these in the south is in the sugar manufacture, and in cleaning and pressing cotton; in the west, in saw and grist-mills, and in various manufactures of iron machinery and tools; and in the east, in mills, in printing, in cotton manufactories, and the public works at navy yards and armories.

The government of the United States owns 17 of these; they being employed at their navy yards to empty docks, saw timber, &c.; and, at some arsenals and armories in manufacturing arms.

The tonnage of all the steam-boats in the United States is computed to exceed 155,473. Of this, 137,473 is in boats ascertained or reported. By the official returns the whole tonnage would now probably equal near 160,000 tons, having been, in A.D. 1837, equal to 153,660. Many boats included in those returns have been lost or worn out, and several new ones built since. In England the tonnage is estimated to have been 67,969 in A.D. 1836. The tonnage to each boat here averages about 200; and the estimates, where the returns have been defective, were made on that basis. The power employed in all steam-engines in the United States is ascertained and estimated at 100,318-horse power; of this 12,140 only is in engines, estimated and not returned. In the aggregate, all this new mechanical force would be equal to the power of 601,808 men. Of this force, 57,019-horse power is computed to be in steam-boats, 6,980 in railroads, and the rest, being 36,319, in other engines. This averages about 70-horse power to each boat, or one horse to between two and three tons, and less than 20-horse power to each of the other engines. It is a striking fact, that the steam-power employed, in only standing engines, is equal to about two-thirds of all that is used in steam-boats. The largest boat in the United States is supposed to be the *Natchez*, of 860 tons, and near 300-horse power, destined to run between New York and Mississippi; the *Illinois*," and the *Madison*, on Lake Erie, are the next in size, the former being 755, and the latter 700 tons; the *Massachusetts*, in Long Island Sound, is the next largest, being 626 tons; and the *Buffalo*, on Lake Erie, next, being of 613 tons. The largest boats passing Louisville in 1837, were the *Uncle Sam*, of 447 tons, and the *Mogul*, of 414 tons; though below Louisville the *Mediterranean*, of 490 tons, and the *North America*, of 445 tons, on the Ohio, and the *St. Louis*, of 550 tons, on the Mississippi, are running. The greatest loss of life, well authenticated, on any one occasion, in a steam-boat appears to have been by collision, and consequent sinking, in the case of the *Monmouth* in A.D. 1837, on the Mississippi river, by which 300 lives were lost. The next greatest were by explosions: on the *Oronoka*, in 1838, on the same river, by which 130 or more lives were lost; and of the *Moselle*, at Cincinnati, Ohio, by which 100 to 120 persons were destroyed. The greatest injury to life by accidents to boats from snags and sawyers appears to have been 13 lost in 1834, in the case of the *St. Louis*, on the Mississippi river. The greatest by shipwreck was in the case of the *Home*, in 1837, on the coast of North Carolina, where 100 persons were lost. The greatest by fire happened in the *Ben Sherrod*, on the Mississippi river, in 1837, where near 130 perished. The number of steam-boats built in the United States in A.D. 1834, was 88; but in 1837 it was 134, or had increased over 50 per cent. in three years. The places where the greatest number of steam-boats and other steam-machines appears to have been constructed in this country are Pittsburg, Cincinnati, and Louisville, on the western waters; and New York, Philadelphia, and Baltimore, on the Atlantic. At Loui ville alone, from 1819 to 1838, there appeared to have been built 244 steam-engines, of which 62 were for boats. The fuel originally used for steam-boats in the United States was wood; but of late years bituminous coal has, in many instances, been substituted, and in several anthracite coal. The latter, from the small space it occupies, would seem to possess a decided advantage in sea-going vessels as well as in locomotives.

Some steam-boats made of iron are believed to be in use in Georgia, if not in other parts of this country, though none of that material have been manufactured here; but it is computed that their cost is less than those of wood, and as they draw less water with the same freight, they are more useful on shallow streams.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 27th OF JUNE AND THE 25th JULY, 1839.

Richard Hodgson, of Salisbury-street, Strand, gentleman, for improvements in the forms or shapes of materials and substances used for building and paving, and in their combination for such purposes. (A communication from a foreigner). June 27: six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements applicable to wheeled carriages, and in springs. (A communication). June 29; six months.

Henry Pape, of Little Newport-street, Leicester-square, musical instrument maker, for certain improvements on stringed musical instruments. July 2; six months.

Henrik Zander, of North-street, Sloane-street, gentleman, for improvements in the manufacture of paper. July 2; six months.

Charles Osborne, of Birmingham, cork screw manufacturer, for a certain improvement, or certain improvements in the construction of cork screws. July 2; six months.

Alexander Cochrane, of Arundel-street, Strand, gentleman, for an improved lock. July 3; six months.

Alexander Cruckshanks, of Liverpool-street, New-road, for certain improved methods of producing or manufacturing certain inflammable substances, and

of applying the heat and light obtained from certain inflammable substances to various useful purposes. July 3; six months.

James Yates, of the Effingham works, Rotherham, iron founder, for certain improvements in making, forming, or producing raised or projecting letters, mouldings, figures, or other ornamental work for external decorations of buildings, and other purposes. July 3; six months.

Thomas Trench Berney, of Morton Hall, Norfolk, Esq., for certain improvements in cartridges. July 6; six months.

Edmund John Jones, of Paulstone House, Hereford, gentleman, and John Ham of Bristol, engineer, for an improved process of manufacturing cider and perry. July 6; six months.

George Philcox, of Southwark-square, watchmaker, for certain improvements in chronometers, watches, and other time keepers. July 6; six months.

John Ericsson, of Cambridge-terrace, Hyde-park, civil engineer, for an improved steam-engine, particularly applicable to locomotive purposes, and steam navigation. July 6; six months.

John Fairrie, of Church-lane, Whitechapel, sugar refiner, for improvements in making and refining sugar. July 6; six months.

Peter Rothwell Jackson, of Great Bolton, Lancaster, engineer, for a new and improved method of mangling, callendering, glazing, and finishing cotton, linen, woollen, and other goods and manufactures, and certain machinery to effect the same. July 8; six months.

Edward Francois Joseph Duclos, of Clyne Wood works, Swansea, gentleman, for improvements in the manufacture of sulphur, sulphuric acid, and sulphate of soda. July 11; six months.

William Woodley, of Observatory house, Stoke Newington, captain in the navy, for improvements in propelling vessels and carriages, and other machinery. July 13; six months.

Thomas Bell, of Saint Austell, Cornwall, hotel keeper, for improvements in obtaining copper from copper slag. July 13; six months.

James Yates, of the Effingham works, Rotherham, iron founder, for certain improvements in the construction of cupola furnaces for melting metals. July 13; six months.

Daniel Ramee, of Paris, but now of Charlotte-street, Bloomsbury, for improvements in paving roads and such like ways. (A communication), July 15; six months.

John Hemming, of Edward-street, Cavendish-square, gentleman, for improvements in gas meters. July 16; six months.

John Reynolds, of Bridge-street, Blackfriars, Esq., for certain improvements in the manufacture of salt. July 16; 6 months.

John George Shuttleworth, of the Mount, near Sheffield, soap boiler, for a new mode of obtaining a rotary motion from the rectilinear motion of the piston rod of a steam or other the like engine. July 18; six months.

Edward Brown, of Lime Regis, Dorset, ironmonger, for improvements in apparatus for cooking. July 20; six months.

Thomas Nicholas Raper, of Bridge-street, Blackfriars, London, gentleman, for improvements in rendering fabrics and leather waterproof. July 20; six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements in casting for printing purposes.—(A communication.) July 20; six months.

Peter Robert Drummond, Lord Willoughby de Eresby, for improvements in compressing peat. July 20; six months.

David Johnston, of Glasgow, manufacturer, for certain improvements in the manufacture of *hinges.—(A communication.)* July 20; six months.

Alexander Southwood Stocker, of the Union Rolling Mills, Birmingham, and Thomas Johnson, *of Ridgacre Iron Works, Stafford, for* certain *improvements in machinery for* manufacturing shoe *heels and toe tips. July 20; six months.*

John Charles Schevieso, of Albany-street, Regent's Park, harp maker, for certain improvements in the construction of locks. July 20; six months.

John Frederick Myers, of Albemarle-street, Piccadilly, musical instrument maker, and Joseph Storer, of Bidborough-street, New Road, musical instrument maker, for certain improvements in the construction of certain musical instruments; part of the said improvements being applicable to those of the kind commonly called piano-fortes, and part to those of the kind commonly called seraphines, and to certain descriptions of organs; being partly a communication. July 20; six months.

Joshua Crockford, of Litchfield-street, Soho, gentleman, for an improved mode of applying cotton and other wicks to tallow and other the like substances used for candles, in order to consume the same. July 20; six months.

Charles Flude, of Liverpool, chemist, for certain improvements in the manufacture of white lead. July 20; six months.

John Hanson, of Rashcliffe, near Huddersfield, York, patent lead-pipe manufacturer, for certain improved apparatus for measuring and registering the quantity of gas, water, or other fluid passed through the same. July 24; six months.

James Kay, of Pendleton, near Manchester, cotton spinner, of an extension for the term of three years from the 26th July, 1839, for a new and improved machinery for preparing and spinning flax, hemp, and other fibrous substances by power.

James Templeton, manufacturer in Paisley, and also William Quiglay, weaver in Paisley, for their invention of machinery for a new and improved mode of manufacturing silk, cotton, woollen, and linen fabrics. July 25; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22ND JUNE AND THE 22ND JULY, 1839.

Richard Beard, of Egremont-place, New Road, Middlesex, gentleman, in consequence of a communication from a foreigner residing abroad, for improvements in printing calicoes and other fabrics. Sealed June 25; four months to specify.

John Small, of Old Jewry, London, merchant, in consequence of a communication from a certain foreigner residing abroad, for improvements in the manufacture of thread or yarn and paper, by the application of certain fibrous materials not hitherto so employed. June 26.

James Lees, of Salem, near Oldham, Lancaster, cotton spinner, for an improvement in the machinery for spinning, twisting, and doubling cotton, silk, wool, hemp, flax, and other fibrous materials. July 2.

John Arrowsmith, of Bilston, Stafford, civil engineer, for certain improvements in steam engines. July 3.

Frank Hills, of Deptford, Kent, manufacturing chemist, for certain improvements in the construction of steam boilers and of locomotive engines. July 3.

Thomas Clark and Charles Clark, of Wolverhampton, Stafford, ironfounders and copartners, for glazing and enamelling cast-iron hollow-ware and other metallic substances. July 4.

Alexander Gordon, of Fludyer-street, Westminster, Middlesex, engineer, for a new machine or apparatus for employing or using steam or other elastic fluid as a motive power, the same having been communicated to him by a certain foreigner residing abroad. July 5.

James Kay, formerly of Preston, cotton spinner, but now of Pendleton, near Manchester, flax-spinner, of an extension of three years, from June 23, 1839, of a patent granted to him, for a new and improved machinery for preparing and spinning flax, hemp, and other fibrous substances, by power. July 11.

Abraham Bury, of Manchester, gentleman, for certain improvements in the mode of printing, colouring, or dyeing cotton or other fabrics. July 12.

Joseph Maudslay and Joshua Field, of the firm of Maudslay, Sons, and Field, engineers, of Lambeth, Surrey, for improvements in the construction of marine steam-engines, which are particularly applicable to steam-engines of the largest class. July 15.

Charles Sanderson, of Sheffield, York, steel manufacturer, for a certain improvement in the art or process of smelting iron ores. July 15.

James Templeton, manufacturer in Paisley, and William Quiglay, weaver in Paisley, for machinery for a new and improved mode of manufacturing silk, cotton, woollen, and linen fabrics. July 17.

Pierre Auguste Ducote, of No. 70, St. Martin's-lane, Middlesex, for certain improvements in the art of printing on paper, calicoes, silks, and other fabrics. July 17.

John Thomas Betts, of Smithfield Bars, London, rectifier, in consequence of a communication from a certain foreigner residing abroad, for improvements in the process of preparing spirituous liquors in the making of brandy. July 19.

David Johnston, of Glasgow, manufacturer, in consequence of a communication from a certain foreigner residing abroad, for certain improvements in the manufacture of hinges. July 19.

Moses Poole, of Lincoln's Inn, Middlesex, gentleman, in consequence of a communication from a certain foreigner residing abroad, for improvements in printing calicoes and other fabrics. July 19.

John Fairrie, of Church-lane, Whitechapel, Middlesex, sugar refiner, for improvements in making and refining sugar. July 19.

Henrick Zander, of North-street, Sloane-street, Middlesex, gentleman, for improvements in steam-engines, steam boilers, and condensers. July 22.

LIST OF IRISH PATENTS GRANTED IN JUNE, 1839.

William Arthur, for improvements in spinning hemp, flax, and other fibrous substances.

W. H. Burnett, for improved machinery for cutting or working wood.

Thomas Walker, for certain improvements in engines and carriages to be worked by steam or other motive powers, part of which improvements is applicable to raising and forcing fluids.

Charles Clark and Thomas Clark, for glazing and enamelling cast-iron hollow ware and other metallic substances.

Abraham Bury, for certain improvements in the mode of printing, colouring, or dyeing cotton or other fabrics.

J. G. Bodmer, for improvements in the machinery or apparatus for carding, drawing, roving, and spinning cotton, wool, flax, silk, and other fibrous substances.

George Nelson, for a new and improved method or methods of preparing gelatine, which has the properties of, or resembles glue.

P. A. Ducote, for certain improvements in the art of printing on paper, calicoes, silks, and other fabrics."

NOTES AND NOTICES.

Wreck of the Royal George.—Colonel Pasley, of the Royal Engineers, whose abilities are so well known, has received orders to remove the wreck of the *Royal George*, by the same means he so effectually employed in the Thames in clearing that river.—*Hampshire Telegraph.*

Soap Suds a Specific for Nourishing Flowers.—A fair correspondent writes to us from Newton Stewart, in the following terms:—"Recently I happened to gather a beautiful pansey, and when tired of admiring it, tossed the toy aside, which partly by accident fell into a box full of soap suds. The said pansey had neither joint nor root, and you may judge of my surprise when at the end of a day or two, I found it growing. From this time forward I watched it narrowly, and now find it, after the lapse of a fortnight, a goodly plant with several buds on it. Thinking water might produce the same effect, I placed a newly cropped pansey in an element, which, pure in itself, is the medium of purity in everything else; but they withered and died on so spare a diet. By way of confirming the first experiment, I have since placed a slip of rose tree and a pink in suds, and both are flourishing in great vigour in my dressing-room. Should this accidental discovery prove useful to florists, it will afford sincere pleasure to your correspondent.—*Dumfries Courier.*

Prepared night Soil Manure.—It is well known that night soil possesses the most efficacious qualities as a manure. It has long been used for that purpose in France and Belgium, and in China it is preserved and prepared with the greatest care. The offensive smell has hitherto been the greatest obstacle which has prevented its use. The difficulty seems, however, at length to have been overcome; Messrs. Payen and Buren, celebrated chemists, in France, having succeeded in producing a powder, the mixture of which with night-soil almost instantly frees it from the offensive smell. It afterwards undergoes further preparation, and when ready for use assumes the appearance of a fine black mould, not in the smallest degree offensive, and so dry and powdery as to be capable of passing through the drill, and being deposited with the seed. A licence to use the French patent in this country has been taken out, and a manufactory of the article has been established in London. We last week inspected the works, and saw several thousand quarters of the manure in different stages of preparation. The process of mixing the powder with the night soil was performed before several gentlemen who were present, and in the course of a few minutes the offensive smell was entirely removed. The efficiency of the manure has been most satisfactorily proved in France. A great many persons have already purchased some of it for the purpose of testing its effects, and we trust they will make the results of their experiments public, for the benefit of the agricultural body. If the thousands of tons of this article, possessing the most powerful qualities as a manure, but now altogether lost in consequence of its offensiveness, can be rendered inoffensive, and therefore available, it will be a most important addition to our present means of production. A quantity sufficient for manuring two acres can be packed in a cask of the size of a sugar hogshead, at an expense of from 30*s.* to 2*l.* per acre. The trouble and cost of a trial are trifling: we therefore hope that some practical farmers in different parts of the country will be induced to try it, in order that a fair opportunity may be afforded of testing its general value, and also of ascertaining whether its effects vary on different soils.—*Farmer's Magazine, July.*

Frozen Wells.—It is mentioned in Silliman's *Journal of Science*, that at Owego, New York, is a well, 77 feet deep, on a table land 30 feet above the Susquehanna River, and three-fourths of a mile distant from it, in which for four or five months in the year the water is *frozen* so solid as to be useless. Last winter, at the measured depth of 61 feet, the ice could not be broken with a heavy iron weight. A thermometer, lately let down, fell from 68° to 30°. The well has been dug about twenty-one years. It is said, that when dug, though in hot June weather, the cold was scarcely bearable. The ice is now often drawn up in June and July. No similar phenomena appear in the vicinity. No rock or slate was thrown up in the excavation. The water is *hard*, and never affected by "freshets." A candle flares at 30 feet down, but grows quiet, and is soon extinguished, at the bottom.

Ericsson's File Cutting Machine.—We were afforded last week, through the kindness of a friend, an opportunity of seeing the file-cutting machine for which a patent was obtained about three years ago by Messrs. Turton and Sons, Spring Works in full operation. It may perhaps be remembered that when this machine was first introduced, it was deemed visionary and impracticable, and the impossibility of its ever superseding the cutting by the hand, was nearly universally admitted. Time and experience, however, have proved that neither the expectations of the inventor (Captain Ericsson) nor the confidence of the purchasers of the patent, have been unfounded or misplaced, as it now turns out files of a more regular and superior cut to the average run of those made by the hand, and in much greater number in the same time. When we saw it it was at work on 18in. round bastard, of which six were undergoing the operation at one time, and the exactness and regularity of the cuts were truly surprising. The principal beauty of the machine consists in the simplicity of its movements and the skilful application of the principles of mechanics in modifying the stroke according to the varying thickness of the steel,—striking lightly at the point, and increasing in strength as the thicker parts of the file come under its action. We were also shown specimens of flat second cut, and hand file smooth, which could not be excelled by the most skilful workman.—*Sheffield Iris.*

Sir James Anderson's Steam Carriage has at last arrived in London, and is now undergoing the finishing touches of a London engineer, previous to its essay at locomotion on the roads of the metropolis.—

Mr. Walter Hancock's "Automaton" is kept in readiness by its persevering inventor, to compete with the long vaunted powers of the machine of the Knight of Buttevant Castle.—

Colonel Maceroni also, we are informed, is preparing to take the road. With his never-failing fountain of vapour (when he has "got the steam he has only to let it on," and run ten, twenty, or thirty miles an hour at the same expense), he will doubtless speedily eclipse his rivals and predecessors. We await the result with some interest.

New mode of illuminating Clocks.—The Horse Guards clock was illuminated for the first time, on Tuesday, July 16, by means of the "Bude light," which falls on the face; thus differing from the ordinary transparent clocks, to which it is much superior, both in clearness and beauty. It gives the clock-face an appearance of being shone upon by a very powerful moonlight.

Invention of the Kaleidoscope Anticipated.—The following description of a new invention may perhaps interest some of our readers, more particularly the manufacturers of fancy articles of dress.—"Since the instrument I now design to treat of," says the author and inventor, "has afforded some pleasure to many of my acquaintances, I have been easily persuaded to make it public. It is of that nature that the best designers and draughtsmen may improve and help their fancies by it. They must choose two pieces of looking-glass of equal bigness, of the figure of a long square. These must be covered on the back with paper or silk, to prevent rubbing off the silver. This covering must be so put on, that nothing of it appears about the edges of the bright side. The glasses being thus prepared, must be laid face to face, and hinged together so that they may be made to open and shut at pleasure like the leaves of a book."—After showing how various figures are to be looked at in these glasses under the same opening, and how the same figure may be varied under the different openings, the ingenious artist thus concludes:—"If it should happen that the reader has any number of plans *for parterres* or wildernesses by him, he may by *this method alter them at his pleasure*, and produce such innumerable varieties as it is not possible the most able designer could ever have contrived.—The invention, it may easily be seen, is not limited to the objects for which it was chiefly designed. If our manufacturers could be persuaded to make use of it, foreigners would not long continue the umpires of fashion, nor boast of their superiority in elegance and variety of design. Parterre and wilderness, forest and mountain, flowery mead and dancing rivulet, would soon transfer all their beauties to the British loom.—What will the inventor of the Kaleidoscope say to this daring inroad upon his patent? The preceding extracts are from the seventh edition of a work on Planting and Gardening, published in 1739, by Richard Bradly, F.R.S., then late Professor of Botany in the University of Cambridge.—*Edinb. Chron.*

Improved Tuning Fork.—We have been favoured with an inspection of an improved tuning-fork, invented and constructed by a mechanic of this place. The peculiarity of the improved fork is, that it is not like the common fork, restricted to the production of one note, but may be made to produce any note within the compass of two or three octaves. This is accomplished by extremely simple means. A stop is made to slide stiffly between the prongs, the effect of which is to check the vibrations in the portions of the prongs included between the stop and the handle. The effective length of the prongs being thus diminished, the rapidity of their vibrations is increased, and the pitch consequently raised. In the fork now before us, the fundamental—that is the note yielded without the use of the stop—is D below the first line of the staff; and the positions of the stop, for the production of the other notes of the scale, up to C, (beyond which the inventor has not yet carried his divisions) are marked on the prongs. These positions are of course in the first instance ascertained by trial. It appears to us that this improved fork requires only to be known to come into general use.—*Aberdeen Journal.*

Daguerre's Photography.—A few days since M. Daguerre exhibited, in one of the rooms attached to the Chamber of Deputies, several specimens of the products of the Daguerréotype. Among them were views of three streets of the capital, the interior of M. Daguerre's atelier, and a group of busts in the collection of the Louvre. The deputies who examined them, and who continued to crowd the room throughout the day, were particularly struck with the marvellous minuteness of detail which these views, and especially those of the streets, exhibited. In one, representing the Pont Marie, all the minutest indentations and divisions of the ground or the building, the goods lying on the wharf, even the small stones under the water at the edge of the stream, and the different degrees of transparency given to the water, were all shown with the most incredible accuracy. The use of a magnifying glass revealed an infinity of other details quite undistinguishable by the naked eye, and more particularly in the foliage of trees. The antique busts are said to have been rendered by this method with very great beauty of effect. The chemical substance upon which the light acts, according to M. Daguerre's method, is laid upon sheets of copper, which, for the drawing, exhibited on Saturday, were about nine or ten inches by six or seven inches. The expense of such plates M. Daguerre estimates at about 3fr. 50c. each, but he expects that considerable reductions may be ultimately made in their cost, and that the improvement of his method will render it applicable to other substances not metallic.—*Galignani.*

The thirtieth Volume of the *Mechanics' Magazine* is published, illustrated with a splendid Engraving of a LOCOMOTIVE ENGINE, on the scale of 1½ in. to a foot—exhibiting the whole of the machinery of the engine, and explaining its action.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 6, Peterborough-court, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE

No. 834.] SATURDAY, AUGUST 3, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

MRS. THOMPSON'S PATENT ALARUM LOCK.

Fig. 3.

Fig. 7.

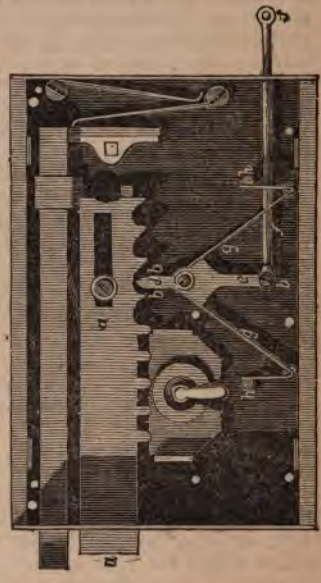


Fig. 1.

Fig. 2

MRS. THOMPSON'S PATENT ALARUM LOCK.

In November 1838, Mrs. Sally Thompson obtained a patent for "Certain additions to locks or fastenings for drawers, chests, or other receptacles, for the purpose of affording greater security against intrusion by means of keys improperly obtained." The inventor has favoured us with a copy of the specification and drawings of her very ingenious contrivances, and we now publish the following description thereof, somewhat abridged from the legal document.

The invention is for the purpose of an alarm before any key can be introduced into a lock or fastening, or before the bolt can be withdrawn; this object is accomplished in the following manners:—

"Firstly, by placing before the key-hole of the lock or fastening, a plate forming a shutter to the key-hole to be removed by being slidden away or being turned on an axis before the key can be introduced into the lock; which shutter shall be in communication with an alarum produced by the vibration of a bell, or other sonorous body situated either within the lock or contiguous to it, or in a room or place to which the motion may be conveyed. And, secondly, by forming a communication from the bolt of a lock to a sounding body, so that the motion of the bolt in being withdrawn shall cause a sound, or a succession of sounds to be given at such place within practicable distance, as the proprietor of the lock shall determine upon."

The invention admits of being carried into effect according to local and other circumstances, in a great variety of forms and modifications; of which those shown in the annexed engravings are given as samples, and afford sufficient information to any competent locksmith to enable him to carry the invention into effect, as variously formed as he pleases.

Description of the Figures.—Fig. 1, a view of the inner side of a lock with the addition of a sliding shutter to cover the key-hole at pleasure, as seen when complete and ready to be screwed on to a door.

Fig. 2, The inner side of a similar lock, but with a revolving shutter.

Fig. 3, The appearance of the works in the interior of the lock, when the shutter and the plate upon which the shutter slides or revolves are removed.

Fig. 4, A view of the back end of the lock (figures 1 and 3), with the spindle and return plate as seen beyond the end.

Fig. 5, Horizontal section from A to B of figures 1 and 3, with the bolt removed to allow the works below the section to be more distinctly represented.

Fig. 6, The key of the lock, with a prolongation for turning the spindle, carrying the pinions which move the shutter and communicate motion to the sounding body.

The same letters of reference signify the same parts in all. *a*, is the frame or case to which the works are affixed; *b*, the return plate at the front end of the lock, which is let in and screwed to the front edge of the door; *c*, the ordinary bolt of the lock; *d*, a screw fixed in the frame of the lock, upon which a slot in the bolt, slides; *e*, the ordinary sliding spring latch; *f*, the spring and lever to throw out the latch; *g*, the ordinary system of wards; *h*, the double lever for sliding back the latch, having the usual square hole to receive the stem of the handles; *k*, the inner plate, commonly called the back plate, inclosing the works of the lock; *l*, the sliding shutter having a toothed rack formed along the under edge, extending nearly from end to end; *m*, a dove-tailed piece sliding in a groove sunk in the plate *k*, to which dove-tailed piece the sliding shutter is secured by two screws; *n*, the two screws holding the sliding shutter to the dove-tailed piece; *p*, the revolving shutter having teeth nearly all around its periphery; *q*, a stud fixed in the plate *k*, upon which the revolving shutter turns; *r*, a toothed pinion by which the sliding shutter is moved longitudinally, or the revolving shutter turned on its axis; *s*, a spindle, turning in the outer plate of the case *a*, and an inner or back plate *k* having an aperture in each end, of a square figure, into which the prolongation of the key is made to fit; this aperture may be of a triangular or other shape, at pleasure; *t* (fig. 6), the ordinary key, having a prolongation of the stem to fit the aperture of the spindle *s*, and by it to turn the pinions which move the shutters and apparatus for communicating

motion to the alarum; t', the prolongation; u, a pinion fixed on the spindle s inside the plate k, for moving a bent lever or crank v; v, the bent lever or crank; w, the fulcrum of the crank; x, the short arm of the lever for receiving motion from the pinion u; y, the long arm of the lever for communicating motion to the alarum; z, a link hinged to the long arm y to lead towards the alarum; z', a box containing a spiral spring represented by dotted lines in fig. 3, which spring returns the crank to its stationary situation, as shown in the

Fig. 5.

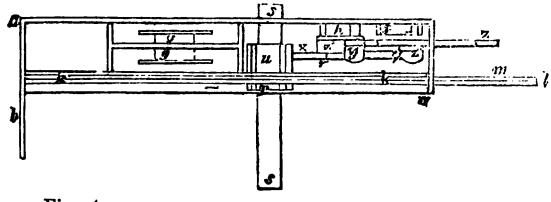


Fig. 4.

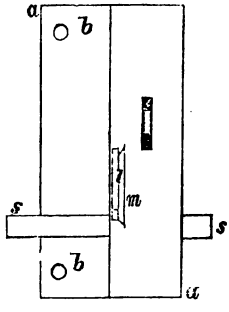
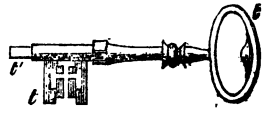


Fig. 6.



drawings, after the pinion u has moved the crank to the left, this spring is of the same construction as those used for the closing of candle snuffers; z'', a spring for returning the crank to its stationary situation after the pinion u has moved it to the right.

Fig. 7 represents a door lock in which the communication with the alarum is made from the main bolt instead of from a pinion, in which case the shutter is dispensed with.

a, the main bolt having four throws, and four ratchet teeth to move the lever and ring the bell at every turn of the key. In this case it will be advisable to make the key with a short bit, in order that there may be the more power to ring the bell. b, the lever, which is here represented straight, except as to two shoulders against which the springs act; c, the fulcrum of the lever; d, the short arm moved by the ratchet teeth of the bolt; e, the long arm giving longitudinal motion to the link f; f, the link to lead the motion towards the alarum; g, two springs counteracting each other, to hold the lever stationary, when not turned aside by the ratchet teeth; h, two studs for abutments to the springs.

It is obvious that the lever may be made either straight or at such an angle as the direction of the alarum shall require.

The principal case in which this invention will be found useful, is in forming a communication from all the locks in the business rooms of a banker, merchant, or other party, with one alarum, or with several separate bells placed in the bedroom of the confidential resident.

THAMES AND CLYDE STEAMERS.

Sir,—"Observator," in your last number, has very properly called to the notice of your readers the very able report of Capt. Pringle and Mr. Josiah Parkes, upon the subject of steam-boat accidents; in which report it is expressly stated that the greatest number of accidents and damage to life and property have occurred with Clyde-built steamers and steam-engines—and this report,

should be observed, is founded upon facts obtained at that port and authenticated by the letters of the Glasgow engineers and builders themselves, (see in Report the letters of Messrs. Napier and others.)

This, Mr. Editor, is pretty conclusive of the great wisdom shown by the owners of the *British Queen* in sending that vessel to what I may fairly term the fatal port of Glasgow, for her boilers and machinery.

Now, had "Observator" perused your pages a little further he would have found in the same report another most important fact stated, viz:—*that in no vessel fitted in the port of London, by London engineers had there ever occurred, during the last twenty years, a single accident to life or property, either by the bursting of boilers or accident to machinery*, except the loss of one solitary life in an experimental boat that was not destined for either passengers or merchandize.

This is a most important and gratifying fact, and redounds greatly to the skill and care of London steam-engine makers, and it ought to be made known to the wide world, for within twenty years there have been no less than 400 steamers fitted in this port—there are more than 300 now plying. The Report also includes the state of the steamers belonging to the Navy, and which, until recently, were all fitted in the port of London, and to which no accident has ever happened. Within these last twelve months, however, our economical government have been buying some cheap ready-hatched things at Liverpool and Glasgow, and, strange to say, the very first accident that ever occurred to any steam vessel belonging to the British Navy, took place this year in the *Urgent*, at Liverpool, when nine or ten persons were seriously scalded; and she too is fitted with Scotch engines. By the bye, I hear this has given their Lordships a serious qualm.

I should not have again adverted to the unlucky *British Queen*, had there not recently appeared in your journal a bold inflated letter from Mr. Samuel Hall, in which he states, that his condensers were used during the excellent voyage of that vessel from Glasgow to London. What his ideas of an excellent voyage may be, I know not, but this is pretty well known, that one of the boilers was seriously burnt and damaged on the voyage, by the water getting off the fire-places and flues;—so much so, that boiler-makers were at work on board the vessel while in London, to enable her to go the voyage. Was this owing to the superior way in which the improved condensers always maintain the *pure distilled water* at the proper level? Perhaps Mr. Hall will inform the public why a gang of Mr. Rennie's workmen were sent for on board the *British Queen* while at Blackwall, whilst another gang, the boiler makers, were rivetting and patching up the damaged boiler? So far, therefore, from the journey round, being what Mr. Hall terms an excellent voyage, it was a very unfortunate one.

Mr. Hall then goes on to state, that a great comparative increase has been obtained in the power of the engines of the *British Queen*, by the use of his condensers, and, as a proof of this, he lugs in the name of a Clyde-fitted ship (unlucky this again for the Scotchman's fame!) named the *India*, to the very great damage of the character of the engines, as I shall prove.

He states that these engines were first tried with common condensers, and that on his being applied they produced an increase in the vacuum equal to three inches of mercury. I can only say they must have been a sorry pair of engines indeed.

Mr. Hall has sometimes at starting got the mercury in the barometer attached to his condenser to 29⅝ in., but the average after a little working may be stated at 29 in. Now supposing he got 29½ in. in the *India* on the day in question, then with the common condensers the *India's* engines could only make a vacuum of 26½! Why, Mr. Editor, a respectable engineer of London would be ashamed to start and work a pair of engines under 28, and I maintain that the average of good boats on the Thames have their barometers standing at 28½. Let Mr. H. go down to London-bridge wharf and take any modern boat, and I will pledge myself to the correctness of the above. So what with Mr. Hall's praise of this pair of engines, and the above Report of Capt. Pringle and Josh. Parkes, Esq., the public will be able to judge of the great wisdom displayed by the managers of the British

Queen. The truth is, Mr. Editor, the interests of the London proprietors of the Company to which she belongs are likely to be seriously affected by a Scotch and Liverpool section of shareholders, who, it appears, are determined, at all hazards and risks, to serve their friends by sending the ships away from the port of London to be fitted with their machinery, notwithstanding the damning facts contained in the Report quoted,—facts long since well known to intelligent and impartial men.

I am, Sir,
Your obedient servant,
PISTON.

LAUNCH OF THE "CYCLOPS" STEAM FRIGATE, THE LARGEST STEAM MAN-OF-WAR IN THE WORLD.

On the 10th ultimo was launched, at Pembroke Dock Yard, the above-named magnificent steam-ship. She glided into the bosom of the ocean with that majestic movement so usual when a British man-of-war betakes herself to her native element.

Her dimensions are as follows:—

Length.....	225 feet.
Beam between paddles	38
Depth of hold.....	21
Tonnage about 1,300.	

She is therefore 200 tons larger than the *Gorgon*, launched from the same slip about 18 months ago. Her equipment as a man-of-war will be the same in all respects as a frigate, having a complete gun or main deck, as well as upper or quarter deck; on the main deck she will carry 18 long 36-pounders, and on the upper deck 4 48-pounders, and 2 96-pounders, tremendous guns, on swivels, carrying a ball 10 inches diameter, and sweeping round the horizon 240 degrees.

Like the *Gorgon*,* she will be commanded by a post captain, these being the only two steamers taking frigate's rank; her crew will consist of 210 men, 20 engineers and stokers, and a lieutenant's party of marines, who will have the charge of the guns.

All the guns move upon slides and fixed pivots, therefore taking a much wider range than the ordinary carriage can give. She will be schooner-rigged, but her fore mast will be of the same scantling and height as a 36-gun frigate's. Her draught of water, with all on board, including six months' provisions, completely armed, and 20 days' fuel, will be 15 feet; this quantity of fuel, 400 tons, will be carried in the engine-room, but there is space in the fore and after hold for carrying ten days' more coal, making in all sufficient for 30 days' run. She has an orlop deck below the gun deck, of such magnificent dimensions that there is space to stow 800 troops and their officers with comfort; so that taking this vessel all in all, she may be considered the most powerful in her Britannic Majesty's service.

This vessel has been built in six months, under the immediate inspection of Mr. Wm. Edye, master builder, of Pembroke Yard, from drawings and plans prepared by his brother, Mr. John Edye, the very talented assistant to Sir Wm. Symonds, the Surveyor of the Navy, upon whose principles of building she is constructed, namely the uniting and combining the sailing and steaming properties together in a most eminent degree, as is the case with the *Gorgon*, also built after his plan.*

We may therefore argue that the *Cyclops* will even excel the *Gorgon*, as experience has dictated many improvements upon that ship; whether we regard the symmetry of her form, the solidity of her construction, or the happy combination of the sailing and steaming properties of this ship, she may fairly be considered as the first in rank of any steamer in the world.

She will be docked in Sheerness Yard, on the 30th August, and after remaining there a few days, will proceed to the manufactory of the Messrs. Seawards, at Millwall, to receive her engines of 320 horse-power, which are constructed upon the same principle as those already in the *Gorgon*, and which have been so successful that the Lords of the Admiralty have ordered five more pairs of engines, upon the same plan, for as many frigates.

We are happy to perceive that the *Gorgon* is commissioned by Captain C. Henderson, K.C.B., a most merito-

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* This vessel, while on the coast of Spain, not only eclipsed all that competed with her while under steam alone, but also in a trial of 300 miles, under canvas, beat the celebrated Pantaloon, hitherto supposed to be the fastest man-of-war afloat.

rious officer, who has already commanded the "Phœnix" and "Salamander," on the coast of Spain, for three years, and she is to proceed immediately to the Mediterranean.

A half-dozen of such steamers would do three times the work, and be much more efficient than an equal number of line-of-battle ships; in fact, we feel confident that such a fleet would be able to destroy any one of the fleets of the Great Powers in the Mediterranean, and with ease, if necessary, force the passage of the Dardanelles, and settle the fate of the Russian fleet in the Black Sea in the bargain. Twelve years ago Lord Cochrane maintained that this could be done by well-appointed steamers, and according to the appearances of things, a short time only will elapse before the experiment may be made.—*(From a Correspondent)*

ASTRONOMICAL PROBLEM.

Sir,—The following is a problem which gives the solid angle in which a planet, &c. will be observed; and also the square degrees of its surface which offer itself to the observer's view. Since the surface of a spheric segment varies directly as its versed sine; let r be the ray or tangent from the eye touching the limb of the planet, and a the radius of the planet; then it will at once follow that,

$6{,}2832r^2 \cdot \left(1 - \frac{r}{\sqrt{a^2+r^2}}\right)$ = the solid angle in which the planet will appear;

and $6{,}2832a^2 \left(1 - \frac{a}{\sqrt{a^2+r^2}}\right)$ = the square degrees of the surface of the planet viewed by the observer.

Sir, I remain your humble servant,
W. SHIRES,
Teacher of Mathematics.

PHOTOGRAPHY—PROPOSED NEW APPLICATIONS.—BY PROFESSOR NICHOL.

[To the Editor of the *Scotsman*.]

Sir,—Living at present in the country, *and occupied in pursuits not connected with passing occurrences, I got your Scotsman of 3rd July, only to-day.* Your own note on *photography, as well as Sir John Robison's very interesting statement regarding the almost miraculous accuracy of Daguerre's representations, or rather reproductions, of external forms and circumstances, fortify me in an opinion which I have held since the first promulgation of this discovery, that it is destined to become an aid in many sciences of observation, of value beyond all estimate. You speak of it chiefly in reference to its effect upon the fine arts and the general culture of taste; but the following remarks will show you that there are other, and if possible, still more important applications of it, quite within our reach; and to which, when you refer to the subject again, it seems to me that the attention of artists and observers may be directed by you with much probable advantage.

1. I find it has occurred simultaneously to a considerable number of persons, that this art will speedily put us in possession of an easy mechanical mode of recording all the more regular phenomena of meteorology. If, as was recently suggested to me by Mr. Sopwith, of Newcastle, a barometer were graduated by etching on the glass itself, the simple addition of a clock-work motion rolling the prepared paper off from one barrel and upon another, by sheets of every hour or half-hour, so that the exposed paper behind the tube should be acted on by a ray of light directed right towards it, the exact condition of the mercury in regard of the scale, would be registered in the most infallible manner, and nothing would remain for the meteorologist, but that which no machine can do,—viz., the reduction and discussion of the records. Beside the barometer, and therefore registered at the same instant, it is clear there might be a thermometer, hygrometer, anemometer, and rain-gauge; so that not only might simultaneous records be thus obtained, but we could get them with a regularity and frequency not now to be hoped for, unless through the machinery of extensive and expensive establishments. In fact, there is a promise *that the mechanical part of such observations may now be conducted by machinery;* and, from analogy of machine spinning and weaving, something of the superior accuracy and facility thence derivable may be faintly imagined. It is greatly to be desired that the attention of our best artists be directed without delay to the effort to make these new powers available. Dou tless there are considerable difficulties in the way of the construction of such an instrument as this referred to; it must be fit for action in such a position as will render its indications of value; its records must be unaffected by parallax; and the light must be thrown upon it so that its condition at the particular and appointed time be alone pictured; otherwise the mark would lose de-

finition. But in the way of the accomplishment of this, there is no natural, not even a serious obstacle. Considering its great importance, however, it certainly does not appear beyond the proper functions of our Society of Arts to stimulate inventors, by offering an especial and very honorary reward for the best model, or even for the best description and drawing. I need not remind you that during night the process of recording may be carried on by the light of lime burned in a jet of oxyhydrogen.

2. It seems possible to note by similar means and in connexion with TIME, *the minute and momentary oscillations of the magnetic needle.* You know, doubtless, that the results already obtained by a comparison of observations on this matter, and set forth in the memoirs of —— and Weber, have clearly brought us into the presence of some new and grand cosmical activity. Now the principal fact, as evolved in these memoirs, of the simultaneity of minute magnetic deviations over a large extent of continent, and in all probability over the whole world, has been obtained only by the great mechanical labour of observing and minutely marking, by refined instruments, at many different places, the position of the magnet *at the close of every five minutes, during twenty-four consecutive hours, four times a-year*— a labour which no establishment whatever could greatly extend. But Photography may not only save us this toil and leave us merely to *discuss* its records, but it *may extend such a series of measurements over the whole year,* and thus furnish within a few years what would in all probability have otherwise been the work perhaps of a century—data whereby in a function of time, the law of those magnetic variations may be expressed, and the yet mysterious influence on which they depend connected with some other of the agencies of nature. I hardly know, in the whole range of science at the present moment, any thing more important than such an application of the Photographic art; and you will be pleased to learn that considerable advances have been made towards its realization by Mr. Jordan of Falmouth, an artist known far beyond his immediate locality—from which, however, discoveries of high value in regard to the earth's electro-magnetism have lately reached us, and where British Photography had its birth. The instability of the magnet even for a few seconds, unquestionably throws obstacles in the way of this application of the art, which will not be felt in other departments of meteorology; but Mr. Jordan is fairly on the way to overcome these; and it is extremely likely that I shall erect one of his instruments as an experiment, in conjunction with the regular magnetic pavillion to be placed in the grounds of our New Observatory at Glasgow.

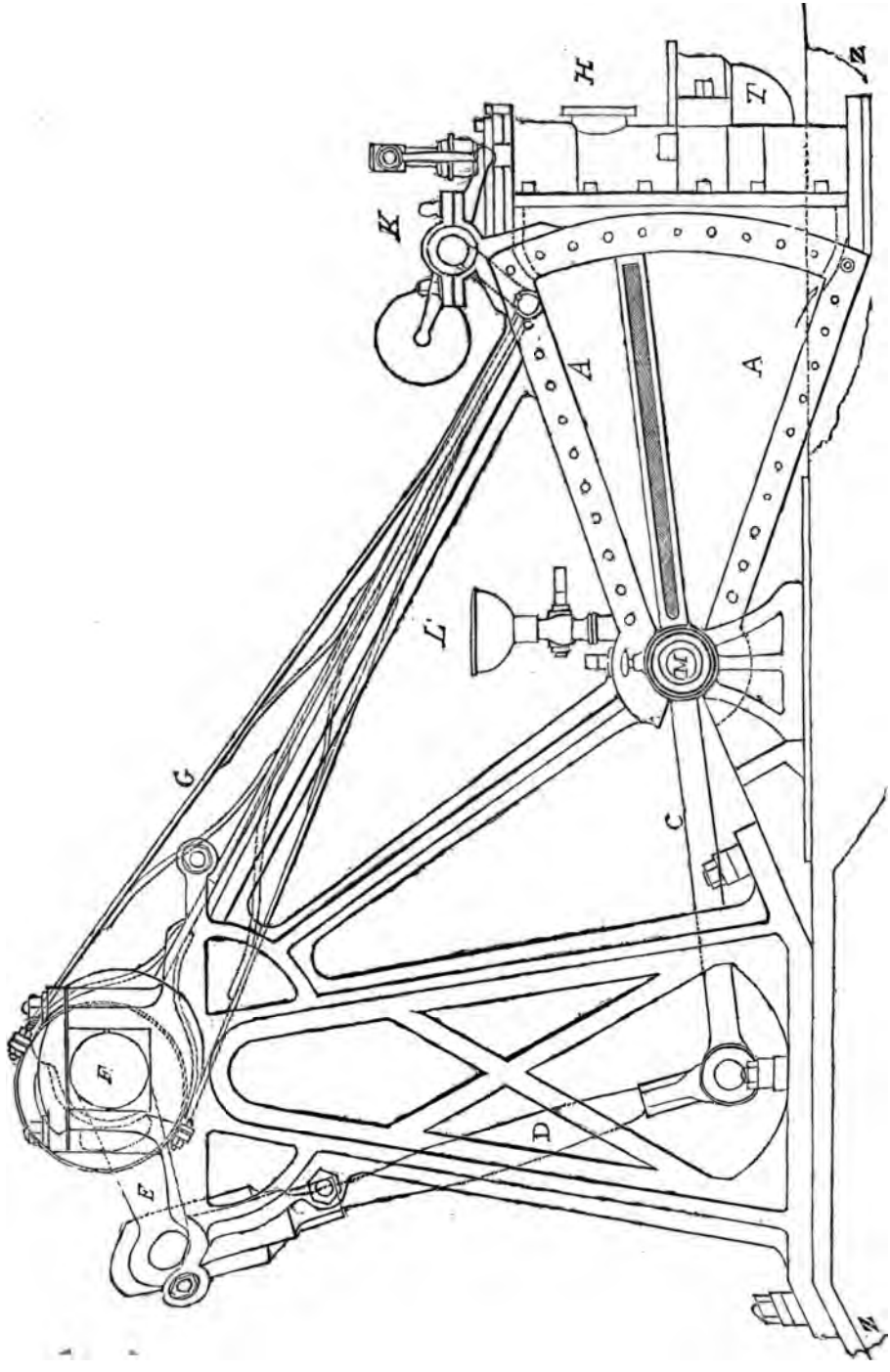
3. The probable and imminent applications of this instrument to my own especial subject are not less important than the foregoing. If, as we cannot now doubt, Daguerre's plates are so sensitive, and if, as reported, he has succeeded in obtaining a *trail* from the passing light of the moon, that luminary will unquestionably record a picture of herself, capable of undergoing miscroscopic scrutiny upon a plate so placed as to receive her image through a large and revolving equatorial. It is not very possible to conceive just now how far the new power thus created of continuously and steadidly examining our nearest planetary neighbours, may advance Geology as a cosmical science; and we may even hope that clusters of stars may in the same manner be made to write for us their form and character, and ultimately the history of their changes. But without regard to Daguerre's art, of which we know nothing, there is one interesting and facile application of British Photography in this department which should not escape notice. One of our most curious inquiries regarding the physical constitution of the external bodies relates to the *spots on the sun.* We know that these are *indentations,* but the cause of such hollows is yet quite unknown; nor can even a conjecture be rationally hazarded on the subject, until the history of many individual spots has been watched and written, the aspect of their production recorded, their changes scrutinized, and finely the mode of their disappearance. Our curiosity has been lately quickened on this subject by statements by Capocci and others—how easily may it be satisfied by aid of Photography! Obtaining the image of the sun through an adjusted equatorial on a roll of prepared paper, moving after definite intervals of time, the ever-changing disc of that luminary would infallibly write down its own history! As soon as my own equatorial is placed, I shall certainly endeavour to realise this idea when circumstances are favourable; and as it is a very obvious one, I have no doubt that other observers, possessed of fitting instruments, will do so likewise.

These remarks, which I hurry to a conclusion, will doubtless suggest to you many other applications of this very remarkable discovery. If so, press them upon the public, so that artists may set to work.

You will be glad to know that the Glasgow Observatory will be completed by next spring, and that it will not be inferior in equipment, in so far as its objects are concerned, to any in Europe.—I am, &c.,

J. P. Nichol.

Dobbieside, July 10, 1839.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SCOBELL'S OSCILLATING QUADRANT ENGINE.

We now publish a description of Mr. Scobell's oscillating engine referred to by Mr. Seaward in his letter published in our 830th number. We do not think there is that striking resemblance to Messrs. Bunnett and Corpe's engine which our respected correspondent seems to consider. A similar motion to that of Mr. Scobell's piston was patented many years ago by Mr. Morgan, who made many and extensive experiments, but with no advantageous results over the cylinder engine, and it has been so often patented and proposed, that we do not imagine Messrs. Bunnett and Corpe lay any claim thereto. We shall, without further comment, now proceed to describe the engine of which the engraving on the opposite page is a side elevation.

A is the quadrant-shaped steam chamber; B the piston, formed of two plates, having between them packing; C, the arm of the piston, being a continuation of the piston; this arm is jointed at one end to the connecting rod D, and at its other end to the crank E, which turns the shaft of the engine F. G is the excentric gear to work the valves K. H I induction and eduction pipes. L the oil cup to lubricate the piston joint M.

The action of the engine is produced, as will be immediately seen, by the alternate entrance and exit of the steam above and below the piston B in the quadrant-shaped chamber A. We shall leave to Messrs. Bunnett and Corpe, or to our intelligent correspondent, Mr. Baddeley, to set forth the points in which Mr. Scobell's quadrant engine is materially defective, and in which it differs essentially from the concentric.

MANUFACTURE OF NAILS—VARIOUS PATENTS FOR NAIL-MAKING MACHINERY.

The forging of nails was till of late years a handicraft operation, and therefore belonged to a book of trades, rather than to a dictionary of arts. But several combinations of machinery have been recently employed, under the protection of patents, for making these useful implements, with little or no aid of the human hand; and these deserve to be noticed, *on account both of* their ingenuity *and importance.*

As nails are objects of prodigious consumption in building their block-houses, the citizens of the United States very early turned their mechanical genius to good account in the construction of various machines for making them. So long since as the year 1810, it appears, from the Report of the Secretary of their Treasury, that they possessed a machine which performed the cutting and heading at one operation, with such rapidity that it could turn out upwards of 100 nails per minute. "Twenty years ago," says the Secretary of the State of Massachusetts, in that Report, "some men, then unknown, and then in obscurity, began by cutting slices out of old hoops, and, by a common vice griping these pieces, headed them with several strokes of the hammer. By progressive improvements, slitting mills were built, and the shears and the heading tools were perfected; yet much labour and expense were requisite to make nails. In a little time Jacob Perkins, Jonathan Ellis, and a few others, put into execution the thought of cutting and of heading nails by water power; but, being more intent upon their machinery than upon their pecuniary affairs, they were unable to prosecute the business. At different times other men have spent fortunes in improvements, and it may be said with truth that more than one million of dollars has been expended; but at length these joint efforts are crowned with complete success, and we are now able to manufacture, at about one-third of the expense that wrought nails can be manufactured for, nails which are superior to them for at least three-fourths of the purposes to which nails are applied, and for most of those purposes they are full as good. The machines made use of by Odiorne, those invented by Jonathan Ellis, and a few others, present very fine specimens of American genius.

"To northern carpenters, it is well known that in almost all instances it is unnecessary to bore a hole before driving a cut nail; all that is requisite is, to place the cutting edge of the nail across the grain of the wood; it is also true, that cut nails will hold better in the wood. These qualities are, in some rough building works, worth twenty per cent. of the value of the article, which is equal to the whole expense of manufacturing. For sheathing and drawing, cut nails are full as good as wrought nails; only in one respect are the best wrought nails a little superior to cut nails, and that is where it is necessary they should be clenched. The manufacture of cut nails was born in our country, and has advanced within its bosom, through all the various stages of infancy to manhood; and no doubt we shall soon b

able, by receiving proper encouragement, to render them superior to wrought nails in every particular.

"The principal business of rolling and slitting-mills, is rolling nail plates; they also serve to make nail rods, hoops, tires, sheet iron, and sheet copper. In this State we have not less than twelve.

"These mills could roll and slit 7,000 tons of iron a-year; they now, it is presumed, roll and slit each year about 3,500 tons, 2,400 tons of which, probably, are cut up into nails and brads, of such a quality that they are good substitutes for hammered nails, and, in fact, have the preference with most people, for the following reasons; viz., on account of the sharp corner and true taper with which cut nails are formed; they may be driven into harder wood without bending or breaking, or hazard of splitting the wood, by which the labour of boring is saved, the nail one way being of the same breadth or thicknesss from head to point."

Since the year 1820, the following patents have been obtained in England for making nails; many of them of American origin:—

Alexander Law, September, 1821, for nails and bolts for ships' fastenings, made in a twisted form, by hand labour.

Glascott and Mitchell, December, 1823, for ship nails with rounded heads, by hand labour.

Wilks and Ecroyd, November, 1825, for an engine for cutting wedge-form pieces from plates.

Ledsom and Jones, December 11, 1827, for machinery for cutting brads and sprigs from plates; it does not form heads.

The first nail apparatus to which I shall particularly advert, is due to Dr. Church; it was patented in his absence by his correspondent, Mr. Thomas Tyndall, of Birmingham, in December, 1827. It consists of two parts; the first is a mode of forming nails, and the shafts of screws, by pinching or pressing ignited rods of iron between indented rollers; the second produces the threads on the shafts of the screws previously pressed. The metallic rods, by being passed between a pair of rollers, are rudely shaped, and then cut asunder between a pair of shears; after which they are pointed and headed, or otherwise brought to their finished forms, by the agency of dies placed in a revolving cylinder. The several parts of the mechanism are worked by toothed wheels, cams, and levers. The second part of Dr. Church's invention consists of a mechanism for cutting the threads of screws to any degree of obliquity or form.*

Mr. L. W. Wright's (American) apparatus should have been mentioned before the preceding, as the patent for it was sealed in March of the same year; though an amended patent was obtained in September, 1828. Its object was to form metal screws for wood. I have seen the machinery, but consider it much too complex to be described in the present work.

Mr. Edward Hancorne, of Skinner-street, London, nail manufacturer, obtained a patent in October, 1828, for a nail-making machine. Its principles are similar to those of Dr. Church's more elaborate apparatus.

Richard Prosser, July, 1831, for making tacks for ornamental furniture, by soldering or wedging the spike into the head. This also is the invention of Dr. Church.

Dr. William Church, February, 1832, for improvements in machinery for making nails. These consist, first, in apparatus for forming rods, bars, or plates of iron, or other metals; secondly, in apparatus for converting the rods, &c., into nails; thirdly, in improvements upon Prosser's patent. The machinery consists in laminating rollers, and compressing dies.

The method of forming the rods from which the nails are to be made, is very advantageous. It consists in passing the bar or plate iron through pressing rollers, which have indentions upon the peripheries of one or both of them, so as to form the bar or plate into the required shape for the rods, which may be afterwards separated into rods of any desired breadth, by common slitting rollers.

The principal object of rolling the rods into these wedge forms, is to measure out a quantity of metal duly proportioned to the required thickness or strength of the nail in its several parts; which quantity corresponds to the indentations of the rollers.

Thomas John Fuller, February, 27, 1834, for an improved apparatus for making square-pointed, and also flat-pointed nails. He claims as his invention, the application of vertical and horizontal hammers (mounted in his machine) combined for the purpose of tapering and forming the points of the nails; which, being made to act alternately, resemble hand-work, and are therefore not so apt to injure the fibrous texture of the iron, he imagines, as the rolling machinery is. He finishes the points by rollers.

Miles Berry, February 19, 1834, for machinery for forming metal into bolts, rivets, nails and other articles; being a communication from a foreigner residing abroad. He employs in his machine holding chaps, heading dies, toggle-joints, cams, &c., mechanism apparently skilfully contrived, but

* *For further details, see Newton's Journal, 2nd series, vol. III., p. 184.*

too complex for admission under the article *nail* in this volume.

William Southwood Stocker, July, 1836. This is a machine apparently of American parentage, as it has the same set of features as the old American mechanisms of Perkins and Dyer, at the Britannia Nailworks, Birmingham, and all the other American machines since described, for pressing metal into the forms of nails, pins, screw-shafts, rivets, &c.; for example, it possesses pressers or hammers for squeezing the rods of metal, and forming the shanks, which are all worked by a rotatory action; cutters for separating the appropriate lengths, and dies for forming the heads by compression, also actuated by revolving cams or cranks.

Mr. Stocker intends, in fact, to effect the same sorts of operations by automatic mechanisms as are usually performed by the hands of a nail-maker with his hammer and anvil; viz., the shaping of a nail from a heated rod of iron, cutting it off at the proper length, and then compressing the end of the metal into the form of the head. His machine may be said to consist of two parts, connected in the same frame; the one for shaping the shank of the nail, the other for cutting it off and heading it. The frame consists of a strong table to bear the machinery. Two pairs of hammers, formed as levers, the one pair made to approach each other by horizontal movements, the other pair by vertical movements, are the implements by which a portion at the end of a redhot rod of iron is beaten or pressed into the wedge-like shape of the shaft of a nail. This having been done, and the rod being still hot, is withdrawn from the beaters, and placed in the other part of the machine, consisting of a pair of jaws like those of a vice, which pinch the shank of the nail and hold it fast. A cutter upon the side of a wheel now comes round, and by acting as the moving chap of a pair of shears, cuts the nail off from the rod. The nail-shank being still firmly held in the jaws of the vice, with a portion of its end projecting outwardly, the heading die is slidden laterally until it comes opposite to the end of the nail; the dye is then projected forward with great force, for the purpose of what is termed upsetting the metal at the projecting end of the nail, and thereby blocking out the head.

A main shaft, driven by a band and rigger as usual, brings, as it revolves, a cam into operation upon a lever which carries a double inclined plane or wedge in its front or acting part. This wedge being by the rotatory cam projected forwards between the tails of one of the pairs of hammers, causes the faces of these hammers to approach each other, and to beat or press the redhot iron introduced between them, so as to flatten it upon two opposite sides. the rotatory cam passing round, the wedge-lever is relieved, when springs instantly throw back the hammers; another cam and wedge-lever now brings the second pair of hammers to act upon the other two sides of the nail in a similar way. This is repeated several times, until the end of the redhot iron rod, gradually advanced by the hands of the workman, has assumed the desired form, that is, has received the bevel and point of the intended nail.

The rod is then withdrawn from between the hammers, and in its heated state is introduced between the jaws of the holders, for cutting off and finishing the nail. A bevel pinion upon the end of the main shaft, takes into and drives a wheel upon a transverse shaft, which carries a cam that works the lever of the holding jaws. The end of the rod being so held in the jaws or vice, a cutter at the side of a wheel upon a transverse shaft separates, as it revolves, the nail from the end of the rod, leaving the nail firmly aheld by the jaws. By means of cam, the heading die is now slidden laterally opposite to the end of the nail in the holding jaws, and by another cam, upon the main shaft, the die is forced forward, which compresses the end of the nail, and spreads out the nail into the form of the head. As the main shaft continues to revolve, the cams pass away, and allow the spring to throw the jaws of the vice open, when the nails fall out; but to guard against the chance of a nail sticking in the jaws, a picker is provided, which pushes the nail out as soon as it is finished.

In order to produce round shafts, as for screw-blanks, bolts, or rivets, the faces of the hammers, and the dies for heading, must be made with suitable concavities.

In 1835, 5,180, and in 1836, 5,580 tons of iron nails were exported from the United Kingdom.—*Dr. Ure's Dictionary of Manufactures.*

MESSRS. CHANTER AND COMPANY'S PATENT STEAM-BOILER, AND SMOKE-CONSUMING FURNACE.

The question relative to the consumption of smoke may now be considered successfully and practically solved; indeed, judging from what we have seen, it is *finally* set at rest by an apparatus of the most efficient and satisfactory description. A steam-boiler, of twenty horse-power, built by Mr. Borrie of the Tay Foundry, has been so constructed as to effect this very desirable and importa

object. The contrivance is as simple as it is efficient. There are no steam-jets, pipes for communicating heated air, blowing-machines, or complicated apparatus of any description, connected with it. No aid from a philosophical stoker is required, nor any attention necessary more than is bestowed in the firing of common furnaces. From what has been observed, we should say that less attention is required in maintaining the fire than is requisite in the common furnaces. A considerable saving of fuel is also effected, which, however, does not wholly arise from the consumption of the smoke, but is effected partly from the otherwise improved construction of the boiler. The additional expense of the boiler over those of the common construction is so small as scarcely to enter into the computation. The furnace is surrounded by water spaces (thus wholly within the boiler) and has two series of fire-bars. The first series, or those next the furnace door, are fixed at a considerable inclination. The second series are placed further in, and below the first series, and have no inclination. The anterior extremities of the former project a few inches underneath the posterior extremities of the latter. Immediately above the posterior extremities of the first series of fire-bars is a water partition guard, attached to the upper part of the furnace. Between the furnace door and this guard, a chamber is formed, which may be denominated the coal-chamber, that being the place into which the coals are put for feeding the furnace. Sufficient vertical space, between the first series of bars and the water partition guard, is left to admit of the coals falling down into the posterior or smoke-consuming chamber, after having been coked in the first or coal-chamber. The relative position of the lower part of the water partition guard and the surface of the coke on the bars of the smoke-consuming chamber is so adjusted that the smoke, before it can find egress into the flues, must pass over the surface of the coke. The construction, thus explained. will make the mode of operation easily understood. The furnace is fed in the ordinary manner; each successive quantity of coal is deposited in the anterior part of the coal-chamber, and, as the furnace in succession requires feeding, the fireman forces back the fuel in the chamber till he has sufficient room for the new feed,—the fuel in the posterior part of the coal-chamber being, by this process, projected into the smoke-consuming chamber. Thus, the latter chamber is entirely *supplied* with fuel in the highest state of *ignition, emitting only a pure flame.* Then *the smoke arising from each* successive feed *in the chamber having, from the* relative position of the water partition guard and the surface of the highly-ignited fuel in the smoke-consuming chamber, to pass under the former and immediately over the surface of the latter, is thus exposed to the intense action of the flame, and before reaching the flues is consumed. The boiler is an active operation on the premises of Mr. Charles Smith, flaxspinner, Dudhope.

From what has been said, it will be seen that the smoke question, which has occupied the attention of so many engineers, and of which have hitherto proved ineffectual in practice, is now practically solved. Manufacturing towns can now, at a very small expense, be completely divested of that impenetrable cloud of smoke which has hitherto enveloped them, and consequently get rid of as great a nuisance as any that ever existed.

We understand that very shortly full particulars, accompanied with explanatory drawings, of this invention will be submitted to the public. It is needless to enlarge on the importance of it, either as regards the health and comfort of the community or the profit of those engaged in manufactures; and we conclude at present by stating our confident hope that our ingenious and enterprising townsman will be able to realize all those benefits, both to himself and his friends, which must attend the successful application of the principle of his patent.—*Dundee Chronicle.*

STEAM ENGINE CASUALTIES IN AMERICA.

[*From Report of the Secretary of the Treasury to Congress.*]

The number of accidents occasioning loss of life or much injury to property, which have occurred in the use of steam-engines of every kind in the United States is computed to have been about 260; of these, 253 are ascertained, and the rest are estimated. Such accidents, by explosions and other disasters to steam-boats, appear to have constituted a great portion of the whole, and are supposed to have equalled 230, of which 215 are ascertained. The first of these, in boats, is believed to have occurred in the *Washington*, on the Ohio river, in 1816. The material accidents in locomotives and other steam-engines in the United States are comparatively few and unimportant, being only 28 in number, and only two in locomotives were by explosion of the boilers. This circumstance is perhaps in some degree to be attributed to the fact that the engineers in locomotives are the most exposed, and have been the most frequent victims, and hence exercise increased care; that little or no irregularities arise from competition; and that the engines rest

steadier, and the supply of water is more regular and uniform.

Of the whole of the accidents ascertained in boats, about 99 were by explosions of the boilers, bursting of some part of the engines, or collapses: 25 by shipwreck, from collision, gales, &c.; 28 by fire; 52 by snags or sawyers; and 24 by causes different or unknown.

The general impression among the most experienced and skilful on these subjects is, that a great part of the boats destroyed by explosions, as well as many lost by fire and other accidents, would have been saved by proper experienced, science and attention, on the part of the engineers and commanders. One principal object should be to ensure a thorough reform on this point, where some change for the better appears already to have taken place.

The improvements in the navigation of the Mississippi and Ohio rivers within the last 40 years, at the expense of something over three-fourths of a million of dollars, have diminished another immediate cause of many disasters—the running upon snags and sawyers. They will be diminished, also, by the increased cultivation of the banks of the rivers. In respect to explosions, the want of a sufficient supply of water in the boilers is believed to be the most plain, direct and frequent cause of them.

Great numbers of the explosions have occurred either at landings, or soon after leaving them, when the boilers became overheated, and a sufficient height of water was not kept up. Some, however, attribute many of the explosions on those occasions to the immediate and great agitation of the water in the boiler on starting, and the unequal density as well as quantity of steam thus suddenly produced. Most of the other explosions have happened in racing between rival boats, which led to the production of an excess of steam, and to heedlessness been the subject of so many patents, all in the management of it, or to neglect in furnishing an ample and prompt supply of water. The steam in these competitions has often been increased to 200lbs. or more on the square inch, instead of the safe and reasonable pressure in common boilers of only from 10 to 60 lbs., according to their character or strength; and this great excess has, in numerous cases, been accompanied by a culpable inattention to the height of the water in the boilers.

The number of lives which have been lost by all the disasters in steam-boats is computed to have been about 2,000, though some think the aggregate treble that number. I have been able to ascertain only 1,676 *killed, and 443 wounded* in steam-boats; and 37 killed and 98 wounded by accidents to locomotives and standing engines.

The amount of property lost (but for estimating which with accuracy no safe data exist) cannot have been less than five or six millions. This would not be more than 25,000 dollars for each boat and cargo on an average, when the value of the boat alone has sometimes been double that amount.

COMPARATIVE ADVANTAGES OF WHEEL AND SWING PLOUGHS.

[*From the Report of the First Meeting of the English Agricultural Society.*]

Mr. Handley, M. P., read a paper, for which a prize of ten sovereigns, or a piece of plate of that value, had been awarded, for the best account of the comparative advantages of Wheel and Swing Ploughs. That gentleman first gave a description of the various difficulties which he had to encounter in the progress of his investigation, from the great predilection to old usages, and then stated that his own experiments had been made on every variety of soil, both clay, limestone, and sandy loam, on ridge and fallow, and alike with skilful and unskilful workmen. In different soils and localities different ploughs were used, in whose favour little could be advanced except from predilection. He observed that the plough was a simple wedge, working horizontally, which cleft the soil and gave it an angle, which it exposed upwards to the atmosphere. It had been said that the wheel ploughs had to encounter great resistance, but the track of the wheels was obviously of less draught than that of a sledge, as was evident from the very small impression which these leave on passing over the ground. On the other hand, a much greater pressure was required in the sowing ploughs from the man in command, in order to enable him to keep their pace. Under his directions a series of experiments had been made by Messrs. Ransome, of Ipswich, with various ploughs, on a stubble field with a sandy soil, the furrows being six inches deep and ten inches wide. He had employed a dynamometer as the test, the index of which had been examined every few yards, from which the medium was taken, the inclination and declination of the ground being very little, and such as could not be taken into account. With a Rutland Plough the weight was 1 cwt. 3 qrs. and 22 lbs., and the draught 2 cwt. 1 qr. and 22 lbs.; with a Bedford Plough, the weight 1 cwt. 3 qrs. 26lb., and the draught 2 cwt. 3 qrs. 24 lbs.; with a Lincolnshire Swing Plough, the weight 1 cwt. and 18 lbs., and the draught 3 cwt.; and in another of the weight of 1 cwt. 1 qr. and

4lbs., the draught was 3 cwt. and 11 lbs.; with a Suffolk Swing, the weight being 1 cwt. 2 qrs. and 18 lbs., the draught was 2 cwt. 3 qrs. 6 lbs.; and in the last experiment, with a Suffolk Wheel Plough, whilst the weight was 2 cwt. 2 qrs. 18 lbs., the draught was but 2 cwt. and 3 lbs. So far from wanting more power in the use of the wheel plough, it was proved by these experiments that less was required. A strong argument had been adduced against the wheel ploughs, that they would make bad ploughmen, but this the author successfully rebutted, by showing that whilst a boy was as valuable in its use at ten-pence a day as a man was at the other with two shillings a day, that the furrows were as good, and made with greater mathematical precision. The advantages he contended could not be estimated too highly, although in many parts of the country, and particularly in Scotland, the wheel plough had fallen into disrepute, on account of the supposed friction of the wheels. In draught, however, or where the fields were dry, it was found that the wheel plough was good where the swing plough was not, and in the Wolds of Yorkshire and many other parts of the country it would be found preferable, from the better purchase which it afforded. The cost of expense was perhaps in favour of the spring plough, but this was of little moment when the superior advantage of the wheel plough was taken into consideration. It was, however, found that certain localities were favourable to different plans, of which it was scarcely possible by any argument to divest them.

MODES OF PRIMING CLOTHS FOR ARTISTS.

[*From Mr. Taylor's Translation of Merimee on Oil Painting.*]

The practice now is, to prime the cloth with oil colour, changing the mode according as the canvass is of a closer or more open texture. When the canvass is very open, and lets the colour through, it must be saturated with size made of glove parings, laid on with a large palette knife or trowel, the edge of which should be blunt, and as straight as a rule, that the couch of size may be laid as evenly as possible; when the priming is quite dry, it must be rubbed with pumice stone, to make it free from lumps; then with the knife, a couch of ceruse is applied; when dry this is also pumiced; a second couch is then put on, and sometimes a third, to obtain a perfectly even surface.

Formerly, the first priming was made with *dark red, mixed with umber,* or with pure *umber; and some sixty years since,* it was *supposed that the drying of this* colour would be quickened by mixing it with litharge; but it has been discovered that pictures painted on these sorts of preparations, in a few years have their surfaces covered with a multitude of little grains like sand; and thus proving that the litharge was badly prepared.*

At the present day, the artists are more careful in such essential matters; and the colourmen, for their own sakes, are excited to prepare their canvasses with more attention, for any negligence in these essential matters would ruin their trade.

Cloth for priming without sizing, ought to be of a closer and more even texture; in this respect ticking is peculiarly advantageous; for though at present it is not to be had of a much greater width than two yards; yet if the manufacturers found a demand for it, they, no doubt, would make it up to any reasonable dimensions. If the cloth is not sized, it will require three or four couches of colour to ensure an even surface; and before a new couch is applied, time must be allowed for the former to dry hard enough to be rubbed with pumice; this is the reason why cloth requires, in preparation, two or three months in summer, and five or six in the winter season.

The time required for priming, may be shortened very much, by making the first and second couches with distemper; and as soon as they are quite dry, and pumiced into an even surface, let the last couch be merely oil, which has become viscous by exposure to the air; this will penetrate the distemper, and render it quite pliant. By the former method, much time is required to dry the cloth. But by this mode, as soon as the oil is absorbed, they may be rolled up like waxed cloths, with perfect safety.† As the pliancy of these cloths depends upon the complete union of the oil with the distemper, the absorption would be greatly facilitated by using a very weak size, mixed with a little oil, and a good quantity of mucilage of linseed meal, or the latter mucilage alone will do if well boiled.

This species of ground may be made in four or five days, which will economise the time considerably. It is even pretended that a picture may be commenced immediately upon one of these grounds when fresh prepared, and that the colours will change much less than they do when used on a well dried

* Had the litharge been very finely ground, that evil effect could not have occurred.

† M. Rey is the first of our colourmen who has adopted this method. He gave to his primed cloths the name of absorbent canvasses; and they have preserved their pliancy for several years. See *Le Bulletin de la Societé d' Encouragement*, (fifth year).

ground; but such is not my opinion: for the viscous oil used in the ground, and to which the cloth owes its pliancy, dries but slowly. Hence the colours, being left too long exposed to the chemical action of the oil, are likely to undergo a change. I would therefore advise, that if circumstances compel artists to paint on such a ground when fresh, they would do well to apply a strong couch of white chalk with a little size in it, to absorb the excess of oil; but it would, in such a case, be still better to paint on a distemper ground.

THE COCKERILLS OF LIEGE.

William Cockerill was a working blacksmith, in England. He was constantly bent upon important mechanical designs, which he longed to have the means and opportunity of putting into execution. As often happens, nevertheless, William Cockerill met with little encouragement in the scene of his early labours, and towards the close of the last century, when he had attained middle life, and surrounded himself with a family, he migrated to the continent. Along with some other skilful mechanics, he proceeded, by the permission of our government, to St. Petersburgh, with the view of following out certain plans of the Empress Catherine, for establishing manufactures in her dominions. The death of the Empress, and the accession of the madman Paul, ruined his prospects in Russia, and after a time he made his escape to Sweden. Here, under the protection of the British envoy, William Cockerill was employed as engineer on some public works, which no native Swedes could undertake. Engineering, however, did not suit his genius, and hearing of the manufactures of Liege and Verviers, in Belgium, which were flourishing in spite of defective mechanism, he imagined that, if he were in either of these places, he should be certain to succeed as a constructor of machines. He proceeded first, as we are told, to Hamburg, where he disclosed the plan of his proposed operations to Mr. Crawford, the English consul—at the same time stating, "that if he could obtain a small pension from the British Government, he would return to England, not wishing to do any injury to his country, by introducing machinery into a foreign one." Mr. Crawford, it appears, approved of the proposal, and communicated it to the Ministry; but no answer being returned at the end of six months, Cockerill proceeded to the Netherlands, there to seek fortune with his own head and hands.

He made offers to some extensive woollen *manufacturers of Verviers*, a town within the province of Liege, to construct for them new machines of his own invention for the carding and spinning of wool, and for other purposes connected with the production of cloth fabrics. The offers were accepted, and William Cockerill forthwith brought his family from England, and settled with them in Belgium. Cockerill's sons were now growing up, and, with the assistance of their hands and his own, he speedily executed all orders, and founded a thriving establishment. The workshop of the Cockerills at Liege became a famous one, and the quantity of machines made for various manufactures was soon very considerable.

In the year 1813, the elder Cockerill retired from business, with a handsome fortune, leaving his two sons, James and John Cockerill, to follow out his trade. They did so for several succeeding years, and at length James also retired with a competency. John, who was now left alone, and who is said to possess the most enlarged mind of them all, erected, in 1815, the first manufactory for steam-engines which had been seen, on a large scale at least, in Belgium. His machines were soon distributed over the whole continent; but this was done far more extensively afterwards, when he erected new iron-works of vast size at the village of Seraing on the Maese, distant a few miles from the city of Liege. The magnitude of this establishment may be conceived from the fact that it keeps in continual motion sixteen steam-engines, of the collective force of 900 horse-power, and employs 3000 workmen. This establishment was organised by John Cockerill between the years 1821 and 1823. Yet, immense as are the operations here conducted, numberless as are the railway projects here perfected, and the steam-engines and machines of all sizes and descriptions here constructed, the establishment of Seraing is but one of the many great concerns which John Cockerill superintends, and of which he is wholly or in part proprietor. He still keeps in action the extensive foundry, originally possessed by his father in Liege; holds large shares in mining and colliery establishments; and possesses large cotton-spinning factories, as well as linen-manufactories, where these stuffs are put into all forms, weaving and printing included. He is also the proprietor of a paper manufactory. All these establishments he in a measure superintends in person, but, at the same time, it is especially remarked of him that he takes care to have the best of servants and overseers, sparing no expense in bringing such persons from all countries of Europe to his various works.

Such are the concerns of John Cockerill, and such are the sources of capital and ma-

terial which lately enabled him to come forward, unassisted and unrivalled, to offer himself as the contracting party with the French Government for the laying down of a railroad between Paris and Brussels; perhaps the most stupendous enterprise of the kind ever undertaken by an individual. This remarkable man, if we may trust to the accounts given of him, is not stimulated in his career of enterprise merely by a desire of personal emolument or aggrandisement, but seemingly regards himself, and acts, as one who has a great mission to execute, that, namely, of peopling the world with machines for the spreading of wealth and comfort among its inhabitants.

There are internal meliorations in the condition of the workmen peculiar to Mr. Cockerill's works, and solely due to his sagacity and genius, at once inventive, bold, and benevolent. Such comforts, for instance, as the robing or clothing-rooms, where the workmen hang up their out-of-door clothes when they come, and their working ones when they go away. Every workman has his place marked by a certain number, and a placard with his name. This is transplanting the habits of the business-office into the work-shop. But what is most striking is a large hall in the centre of the works, with a stove in the middle of it, neatly ornamented like most of the Belgian stoves; and upon this stove, morn, noon, and eve, there hangs a kettle filled with warm coffee. It is in this hall that all the workmen meet at certain hours of the day, in the intervals of labour, and take their coffee, men and foremen together, the latter holding a certain moral presidence, which the others willingly acknowledge. They here chat without noise or quarrelling, until the sound of the clock calls every man to his duties again.—*Abridged from the Edinburgh Journal.*

NOTES AND NOTICES.

Iron Vessels.—The proprietors of the *Great Western* Steamer are about to build a ship of iron, of about 2,000 tons tonnage, with engines of 1,000 horse power. One of the iron steamers lately made the voyage from Glasgow to Liverpool and back in 46 hours.—*Times.*

American Timber Rafts.—The steam-boat *Relief* towed from Port Deposite, on Wednesday, in a single trip, no less than 101 rafts of lumber, and four arks laden with produce. The aggregate amount of the lumber in this long line of rafts, is estimated at about *five millions of feet.* * * Besides 25 million feet plank and boards, there have come down to Pittsburgh large rafts of logs, scantlings, shingles, &c. The value of the whole *one million of dollars,* or about one half the whole amount which it usually is at the end of the season."—*Baltimore Patriot.*

Stirling's Artificial Fuel.—A new description of fuel for steam purposes has lately been invented by Mr. Stirling, of Limehouse; and an experiment to prove its superiority over even the best Welsh coals, was made last Saturday, at the furnaces of Messrs. W. Fairbairn, engineers, at Mill Wall, Bankside, under a high-pressure engine, during the long period of eleven hours, with the most perfect success. The saving in fuel alone was not less than twenty per cent. in comparison with that description of the best coals usually used in the works of these gentlemen; and the space occupied by Mr. Stirling's fuel was alone one-third less than that usually set aside for coals. The Lords of the Admiralty have directed another experiment to be made of the properties of this fuel at Deptford, where, should it be equally successful, a new era will speedily be created in steam navigation, the superiority of Mr. Stirling's invention being made manifest in a considerable saving in expense, in the creation of a much more powerful heat than can be raised from the same quantity of coals, and, what is still more important, in an immense saving of room on board ship.—*Mining Journal.*

Hutchison's Gas Purifyers.—Sir—In the *Mechanics' Magazine,* for June 8, No. 826, there is a drawing and a description of "a novel mode of purifying gas," by Mr. Hutchison, of the London Gas Establishment. Now, Sir, I have been working a set of four purifyers with a circular hydraulic tank, in every respect the same as those described by this gentleman, for nine years past, and as I did not presume to think there was any novelty in the arrangement at that time, I must say I should have been very much amused with the ingenious modesty that could trumpet forth its unknown merit in 1839, did I not think, Mr. Editor, that the valuable pages of the *Mechanics' Magazine* are deserving of a more beneficial appropriation. Indeed, we must see something claiming with more justice the attention and imitation of gas engineers, than the puffs that have hitherto accompanied Mr. Hutchison's name, before he can be entitled to the credit of novelty in the descriptions he has hitherto favoured us with, whether of apparatus for purifying gas, or economy in the working of retorts. I have no wish whatever to deteriorate from the value of any real improvements which the ingenuity of Mr. H. may suggest in the manufacture of gas, but as practical result is the one thing needful, I would take the liberty of stating that the only criterion by which the public can judge of the manner in which a public gas establishment is conducted, consists in the accommodation to the consumer of a low rate of charge, and the satisfaction to the shareholders of a good annual dividend.—R. Young. Nottingham, July 26, 1839.

Feeding Steam Boilers.—Sir—I observe in Capt. Pringle and Josiah Parkes, Esq.'s Report on Steam-Boat Accidents, an allusion to a separate engine to feed the boiler. Some years ago I directed the Engineer's attention to a separate condensation, and a small engine for the purpose of supplying the boilers, not altogether as to steam-boats, but where good condensing water cannot be procured in large quantities; that is, if a quantity of pure water could be obtained sufficient to supply the boiler, let this quantity be applied to condense separately other impure condensing water, for the sole purpose of supplying the boiler, and this to be at a much higher temperature than common condensed water. Also a small feeding engine, to feed or supply the boilers when the engine is idle, should the boilers become low, or a leak in the boilers, &c. &c.—D.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 166, Fleet-street.*—*Sold* by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

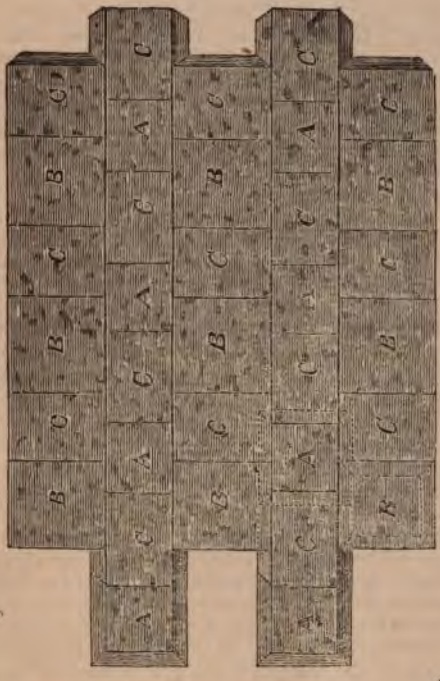
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 835.] SATURDAY, AUGUST 10, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

CAREY'S PATENT WOODEN PAVEMENT.

Fig. 1.



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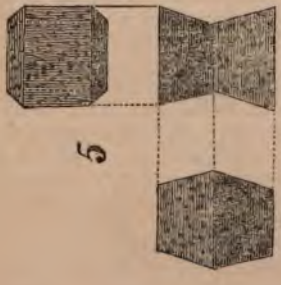

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STEAD'S, BROWN'S, AND CAREY'S PATENT WOODEN PAVEMENTS.

The success of the experimental wooden paving of part of Oxford-street, has given rise to a host of new modifications of the system, and the great extent of field that exists for the profitable application of that system, has, of course, led the various inventors immediately to secure to themselves a monopoly of their respective plans by patent. Mr. Stead (the layer of the Oxford-street pavement) is the earliest patentee, we believe, on the record. His patent is dated May, 1838, and merely consists in giving the blocks of wood hexagonal and square forms, so that they shall fit closely together, and not leave so great spaces between as would be the case with round blocks cut from the tree. We extract the following description from his specification:—

"The invention consists of a mode of paving by means of wooden blocks cut or formed of similar sizes or dimensions."

He then describes his road as "laid down with blocks of wood of a sexagonal figure, which figure at once offers the advantage of going together, and also that the lines of junction proceed in varied directions by which the blocks of wood will sustain each other more securely than if formed of any other figure. He does not, however, confine his claim to sexagonal blocks, as triangular or square blocks laid diagonally, may be used with advantage. And in order further to secure the blocks from sinking or getting displaced, he employs dowels or pins to each block, though he does not consider this requisite in all cases. The blocks of wood are to be placed on the earth, or formed with the grain of the wood in a vertical position; and in applying such blocks as a paving, the surface of the road or other such way is to be prepared in as solid a condition as possible, and to the figure or intended slope; and the blocks are to be successively applied, having sand or other fine filling, driving each block up to those against which it is to rest, having first introduced the dowels or pins. The wood should be of a hard and solid texture, such as oak, pine, or beech; and that the size of the blocks for public roads and streets should be about seven to ten inches diameter at top, slightly diminishing to the base, and about nine to twelve inches in height. The wood, employed should be first boiled in tar or saturated by other suitable material, acting as a preservative to the wood, and it will be found advantageous to fill up the interstices between the blocks of wood with melted pitch, or pitch and sand or earth combined, though this is not essential, and he makes no claim for such using of pitch and sand or earth."

Mr. Stead has since obtained another patent, of which, as the specification has not yet been enrolled, we are unable to give our readers any particulars. The Old Bailey is being paved by Mr. Stead, and upon the carelessness and slovenly manner in which the work is done, we published some strictures by Mr. J. I. Hawkins, in our 733rd number. We regret this the more, as should the plan fail in so public a thoroughfare, it will be calculated to produce a bad impression upon the public mind as to wooden pavement in general, instead of the fault being assigned to that particular plan alone, or rather its careless execution. Mr. Stead, we have heard, undertook to lay down the pavement in the Old Bailey in *sixteen hours*; it is now scarcely finished, *and more than sixteen days* have passed.

The next patentee of a wooden pavement is a Mr. Brown, of Castle-street, Oxford-street, whose patent is dated November, 1838. His plan is very similar to that suggested by our correspondent "Junius Redivivus" in our last vol., p. 230. He proposes cast iron, or other metal frames into which a number of the wooden blocks are to be fitted,—and these frames are to be laid side by side, and so to form the pavement.

Mr. R. Carey, of Breadgar, Kent, next obtained a patent, in January of the present year, and as considerable expectations have been raised of its capabilities, we now publish the descriptive part of the specification at length. It was inrolled on the 29th ult. The objection (which we think a fatal one) to this plan, is, that no one of the blocks can be taken up separately—in fact, that a pavement so constructed could not be taken up at all, without breaking some of the blocks, to allow the others to be taken out sideways.

Description of the Engravings (See front page).—"Figure 1 represents a plan of part of a paved or covered surface of a road or way constructed according to the invention. Figure 2 is an edge view thereof. Figures 3, 4, and 5, being various views of separate blocks. In

each of these figures the same letters indicate similar parts. Such paving or covering consists of the combined use of three separate forms of blocks constructed or formed of any suitable material for the paving of roads, streets, or such other ways. The block A is larger at or about the middle of its length at the line 1 1, and is of a quadrangular figure, the upper and lower ends of this block 2, 2, and 3, 3, being of less dimensions than at 1, 1, as is shown at figure 3; hence, supposing this block to be closely surrounded with blocks having concave surfaces the reverse in figure or shape of those produced by the slopes 1, 2, and 1, 3, the block A would be immoveable; and I would remark, that although I have shown the block A to have angular surfaces produced by the lines 1, 2, and 1, 3, yet it will be evident, that a like result would be produced so long as the diameter of an intermediate point between the top 2 and the bottom 3 of the blocks A, existed, whether the surfaces or sides of the blocks were produced by angles or curved lines, so long as the surrounding blocks had the reverse surfaces of A, in like manner to what has been before stated. The blocks B offer surfaces the reverse of the surfaces of A, for it will be seen that the intermediate diameter between the top and the bottom of the block B is smaller than the ends or upper and lower surfaces of the blocks B, the upper and lower surfaces of the blocks B, corresponding in dimensions with the larger diameter of the block A, and the smaller diameter of the block B, corresponds with the dimensions of the upper and lower ends of the block A; all which will readily be traced in figure 4 of the drawing. The block C differs in construction to the blocks A and B, and may be said to be composed partly of the surfaces of each, as will be seen in figure 5, for two opposite sides of the block C are formed similar to two opposite sides of the block A; the other two opposite sides being formed similar to two opposite sides of the blocks B. And it should be remarked, that all four sides of the blocks A correspond with each other, and such is the case with respect to the sides of the blocks B, but the blocks A and B differ in their construction, and the angles, or inclined or curved surfaces of the one are convex, and the other concave, having, however, such relation to each other, that they will fit accurately together; all which is clearly shown in the drawing, and their mode of going together will be readily understood on examining figure 1, where several of the sides of the blocks A B and C are shown combined together; and it will be seen, that owing to the nature of the figures of the three blocks when they are combined together, the combination will be such, that each block will be surrounded by six blocks, which will retain such block from movement upwards or downwards, and retain the surface complete, owing to the circumstance of each block being so formed in respect to its neighbouring blocks, as to receive support from, and give support to each other. In addition to which circumstance no block can be driven out of its place when once properly placed. The formation of the proper surfaces for receiving pavements being well understood, as well as the necessary formation of the footways, gutters, and other necessary parts of roads and ways being well understood, I have not thought it necessary to enter into any description thereof, in this, my specification; but it should be remarked, that for the sides of the road it will be necessary to have half blocks to come against the gutters, in order to make the surface complete. In conclusion, I would remark, that although I prefer the combination at all times of the three figures, or formations of blocks above described, at the same time, I do not confine myself thereto, as a very good roadway, or pavement may be formed from rectangular blocks having each only two sides formed with concave and convex surfaces, as herein explained, leaving the other two opposite sides plain; by this means the blocks running transversely across the road, street, or way, would mutually support each other, and prevent any particular block sinking, but the only support they would receive in a direction lengthwise of the road, street, or way, would be the plain surfaces of each other. In using wood for a pavement, I prefer that the grain should be vertical, and that each block should have a groove formed in the upper surfaces to give the horse's foot hold to prevent slipping, and when the blocks are of large dimensions, and of stone, or other suitable material, I also recommend, like grooves, for the same purpose."

GOODWIN'S PATENT ARTIFICIAL FUEL.

So numerous have been the patents obtained for inventions of artificial fuel, that one would think we were fast approaching the period prophecied by the geologists as that when the coal fields of England would no longer supply us with fuel. All these patents too have a most extraordinary family likeness; and we are sorry to be compelled to say, that we fear they will not all prove legitimate, should the question ever be in issue. Mr. Goodwin, a coal merchant of Camden Town, last year obtained a patent for an improved fuel, of which we have been favoured with a description.

Each patentee, of course, finds some one new ingredient which he fixes his claim upon, and declares to be essential to the composition of his fuel, and in the beneficial qualities of which his improvement rests. Mr. Goodwin claims as new the road mud, mire, or scrapings of highway roads or streets, as applied to the manufacture of fuel, because, he states in his specification "it is in itself inflammable and combustible, as it contains iron and steel in very small and innumerable particles, which is perpetually being chafed from the shoes and shoe nails of horses, and from the tires of carriages; this (he continues) brought into collision with flint stone (with which also this mud or mire abounds) of themselves produce fire."

Mr. Goodwin uses the following ingredients to compose his fuel:—

Seven parts of fuller's earth, or strong blue clay, or the mud from the bottoms of rivers, canals, or ponds; two parts of coal tar or pitch; eight parts of small coal, such as will pass through a quarter inch sieve; and three parts of mud, or street scrapings, from either macadamized or paved roads.

These various component parts are combined in the following manner:—

First, there is placed a layer of the fuller's-earth, clay, or mud; then one of the two parts of coal-tar, or pitch, is poured on it; after which, the eight parts of small coal is spread into a layer upon the former; then another layer, consisting of the mud, or scrapings of the public *roads; and add, lastly,* the remaining *one-part of coal-tar, or pitch.* If the *mud, or scrapings, be in a fluid* state, it will probably contain sufficient water for mixing the whole, but if nearly dry, a sufficient quantity of water must be applied to cause the whole of the materials to amalgamate. The whole is now turned over with a shovel, and mixed; and afterwards, for the more perfect incorporation of each component part with the other, the whole is ground in a mill, worked by horse, steam, or other power, the mill being constructed on a similar principle to those used for grinding or mixing brick-earth or mortar. The ingredients being thus thoroughly compounded and reduced to about the consistency of clay prepared for tile-making, it may be formed or made into any convenient shape by the hand or in a mould, and afterwards dried in the same manner as bricks, and when hard, the fuel will be fit for use. When the fuel is about half dry, it is susceptible of compression, and may be reduced from the original size full one-sixth, or more, still retaining its full strength as a fuel.

The reasons given by Mr. Goodwin for the use of these various ingredients, are as follows:—

The fuller's-earth, blue clay, or other earthy material is for binding or holding the other matters together. The road mud, or scrapings of the highway roads or streets, we have already stated his reason for using, and he further states that "the mineral and vegetable parts and qualities of the road mud he considers to be in their very finest state of applicability for burning purposes, not having been washed of their native strength in the common sewers, nor finally deposited in the river, where it becomes mud necessarily exhausted of its greatest strength and finest qualities by the flowing and ebbing tides, and constantly in an almost state of inundation, which is well known to be ruinous to the very best and strongest coal produced in the kingdom." The coal used being all small is with a view to its entire incorporation with the other materials, and to bring it into the most important use in giving or imparting to the fuller's-earth, clay, or loam, a mouldering tendency, reducing it to ashes. The unctuous qualities of tar or pitch are so great that in being well mixed with fuller's-earth, clay, or loam, it becomes, when lighted, a kind of cemented body of fire, and in like manner also diffuses its bituminous power into

the mire or mud. The qualities of the road or highway mud, or mire, are peculiar and most important; first, it gives to the fuller's-earth, clay, or loam, an additional readiness for crumbling into ashes when submitted to the action of fire, instead of its forming a hard substance or kind of stone or brick in the fire; the grit of stone and sand in the mud or mire occasions this, in a great degree, loosening or separating the glutinous or binding qualities of the fuller's-earth, clay, or loam; also the pulverized iron and steel it contains, gives to this fuel an intensity of heat not found in any coal. The vegetable matter, this mud or mire also contains, such as corn, clover, hay, and straw, after the partial decomposition it undergoes before it forms a part with the other numerous ingredients, vegetable and mineral (found in road mud or mire), added to the well-known bituminous properties of tar, pitch, and coal, produce a superior and economical fuel for all domestic and manufacturing purposes."

Steam navigation seems to have been the main object of Mr. Goodwin's thoughts, in devising this fuel; he states that it will be found equal to Merthyr coal in heat, and as spreading in its flame as the Hartley Main, and that it consequently presents to the steam navigator most incalculable advantages.

THAMES AND CLYDE-BUILT STEAM-BOATS.

Sir,—Observing in your highly-intelligent journal a high-toned discussion on the comparative merits of Glasgow and London-built steam-boats, between two correspondents, "Observator" and "Piston," I beg, as these gentlemen seem to think they have it all their own way, to say a few words, deduced from experience, in refutation of their wholesale and rather too free arguments.

In the first place, I flatly deny that London or English engineers are one whit superior in any respect to Glasgow or Scottish engineers, but on the contrary, I decidedly prefer the large ocean steamers of the latter to the former. Let any one travel by the Thames river steamers, and then go and take a trip by the fleet, strong, and beautifully-built Clyde boats, and then say without prejudice which he prefers. Let any one travel by the Leith and London Scotch-built steamers, and the London and the continental steam-boats, and who can doubt the answer that would here be given as to the superiority of either class of Scotch and English-built boats, in all that concerns speed, safety and pleasant sailing. The Scotch boats I uphold to be unrivalled, and with confidence say, that no engineers in the world are more ably qualified for the just, cautious, and accurate execution or manufacture of marine steam-engines, than are the Scotch. There are none more, or equally, ingenious—none more ready to adopt improvements, and none more considerate and careful as to the perfect safety of the boilers and engines they turn out.

Several outrageous statements, which your before-named correspondents please to designate "facts," as to the number of accidents and damage to life and property, happening with Scotch boats, I will not detain you long by satisfactorily explaining, as not attributable to *ill-made engines or boilers*, but to the *mis-guidance of these engines and boilers*—in working beyond their calculated power, by over-loading the safety-valves, by collisions, &c.; and more than all, that by the avarice or parsimoniousness of steam-boat companies, who, finding that their orders can generally be more cheaply executed by Scotch engineers than London ones, run to them, and instead of being liberal in their dealings, screw them down to contracts, not consistent either with good materials or workmanship. Thus arises that abominable competition which brings the question to "who will make engines and boilers at the cheapest rate," though, of course, engines thus produced are by far the dearest in the end.

Thus the Scottish engineer, who, in reality, possesses abilities in the highest degree qualifying for his "line" of work, unless he chooses either to be without orders, or makes engines properly at his own expense for steam-boat companies, must have his reputation endangered, as an efficient mechanic. Nothing could be more ridiculous or absurd, nothing more unjust or untrue. I have referred in these Scotch boats, which have beyond doubt been proved unworthy, but in the whole general mass of Scotch navigation the *vice versa* of these statements apply.

No one need regret that the Britis

had her engines and boilers put
Glasgow, notwithstanding all
)quence of Mr. "Piston," and
ur "Observator," on the point.
ily one solitary life," says Mr.
n," has been lost by London-
)oats, fitted with London-made
iery "during the last twenty
What an extremely true state-
I rather think that Mr. "Piston"
n so "*well packed*" when he quoted
nistake, that he had no vacancy
him for anything like a "clear
y," (unlucky this again for the
iman's fame!) it is not true!
a, Sir, most respectfully yours,

A CONSTANT READER.

RINTING BY MAGNETISM.

—Not having either seen or heard
method of producing impressions
ns of magneto-electricity or na-
agnetism, I have been induced
ard you my thoughts upon the
, as well as the method I pro-
employ, and which I deem not
a highly practical character, but
of producing impressions fully
o lithography.

ie first place having procured a
and suitable steel plate, it is to
kened over, and the design traced,
ns of a highly magnetized steel
with the point not sharp, but
rounded, holding the needle in a
position, and bearing pretty
upon the plate, keeping the
as near as practicable in the mag-
eridian.

if a plate so treated, or magne-
)e carefully cleaned and dried,
ry fine iron dust be sprinkled
, the dust will be found upon
g the plate, to adhere only to the
ssed over by the needle. Having
)tained a visible outline, the im-
ı is to be communicated to the
y means of a lithographic press.
)aper (such as generally printed
will required to be prepared for
pose, as it will not do to allow a
iron to combine with paper. A
l blue impression is produced by
ing the paper with a solution of
ssiate* of potash (forming Prus-
sian blue). A good black is produced by moistening the paper with a weak infusion of nut galls (forming gallate of iron).

The impressions will require exposure to the air for a short time that they may acquire a full colour, and the iron must be in the minutest state of division, in order that the chemical change may readily take place; the method of preparing the iron dust is as follows:

Having procured some very fine and bright iron filings, they are to be washed in highly rectified spirits of wine, and when perfectly clean, they are to be well agitated as before in the spirit, allowing the mixture to stand three, four, five or more seconds before pouring off the supernatant liquor which will be found to contain iron as fine as flour, the precipitate then is to be quickly dried and put into a close stoppered bottle for use.

I anticipate that drawings of this sort will have an appearance something between lithograph and mezzotinto, and had I but the means of carrying out my plans, I should not despair of being able to produce a beautiful and variegated landscape.

Another advantage I presume will be the great number of impressions that could be taken from one design, as its durability will not depend upon the number of impressions, but the lapse of time after fixing the design upon the plate; to prepare the plate for a new design it will require to be heated when the magnetic virtue will be expelled.

Should this interesting subject be taken up with spirit, great and important improvements would be effected, and we should have the magnetic fluid not only guiding our course o'er the deep blue ocean but through the still thicker mazes of science.

I am, Sir,
Yours most respectfully,
W. JONES.

ussiate of potash 1 oz., muriatic acid 2 gallon.

ANOTHER CAMBRIDGE PUMPING QUESTION.

Sir,—There is another Cambridge pumping question that was proposed about twenty-five years ago, which is far more difficult than the last; it is as follows:—

"The hold of a vessel partly full of water (which is uniformly increased by a leak,) is furnished with two pumps worked by A and B, of whom A takes three strokes to B's two, but four of B's throw out as much water as five of A's. Now B works for the time in which A alone would have emptied the hold; A then pumps out the remainder, and the hold is cleared in 13 hours and 20 min. Had they worked together the hold would have been emptied in 3 hours and 45 min., and A would have pumped 100 gallons more than he did. Required the quantity of water in the hold at first, and horary influx of the leak?"

A WESTMINSTER SCHOLAR.

MR. SCOBELL'S VIBRATORY, AND MESSRS, BUNNETT AND CORPE'S CONCENTRIC STEAM-ENGINES.

Sir,—I hasten to respond to the invitation, given in your last number (page 329) to point out the defects of Mr. Scobell's oscillating quadrant engine, and the principal points in which it differs from Messrs. Bunnett and Corpe's concentric engine. As each of these inventions are now fully before your readers, it is needless for me to occupy your valuable space by an extended exposition of that which must be pretty apparent to most of your scientific readers.

I would wish, however, briefly to observe, that the principal defects of Mr. Scobell's engine, are, a difficulty of packing, so as to obtain a perfect resistance to the escape of steam, especially about the axis, and the still greater difficulty of keeping the packing steam-tight for any length of time. Secondly, the unequal motion, and consequently unequal wear of the fan, or piston, besides the considerable loss arising from the unfavourable action of the steam near the centre of motion.

In addition to this, from the limited range of the motion, the arc described by the extremity of the piston-arm (c, page 328) does not sufficiently approximate to the motion of the crank to realise the several important advantages obtained by Messrs. Bunnett and Corpe in their concentric steam-engine. In this latter contrivance, all the defects enumerated as peculiar to the *vibratory class, are most* successfully overcome; there is no axis to pack—the piston being self-adjusting; nor is there much difference between the relative motion of its parts. Besides which, the range of the piston being considerable, the arc of the piston-rod assimilates so very nearly to the motion of the crank-pin, that a harmony of action is produced, from which immense advantages result.

There are certain defects inherent in all the vibratory engines hitherto produced, whether for hydraulic or pneumatic purposes, which Messrs. Bunnett and Corpe have most ingeniously avoided, and at the same time they seem to have realised such important practical results as have scarcely been anticipated by their predecessors.

I remain, Sir,

Yours, respectfully,

WM. BADDELEY.

August 6, 1839.

ANOTHER NATURAL PARACHUTE.

Sir,—In your valuable magazine of the 27th inst. there appears a communication signed "Wm Bland," on the seeds of the stag's horn; recommending their shape as a pattern for parachutes. Since it is said there is nothing new under the sun, it must follow that any attempt of man to construct a safe parachute after his own design, stands great chance of failure. Where then are we to look for this desideratum? I answer, in the perfect field of nature, as Mr. Bland has very properly done, and as I should recommend every one to do who would have a faultless pattern. Such was my course immediately after the fatal descent to Mr. Cocking took place, when every one's attention was alive to this subject; and the result of my search was the adoption of the *convolvulus*, as a suitable pattern for a safe parachute; which on being launched into the air, descends steadily to the ground, stalk downwards. At the time, I set about the construction of a machine after this plan, on a very small scale, but delaying to perfect it, my attention to this subject died away as Mr. Cocking's accident was forgotten, and it now remains at home unfinished. Should any of your readers think favourably of the design they may perhaps be induced to try it.

I am, Sir, yours very respectfully,

C. W. H

Walworth, July 30, 1839.

HOT-HOUSE HEAT REGULATOR.

Fig. 1.

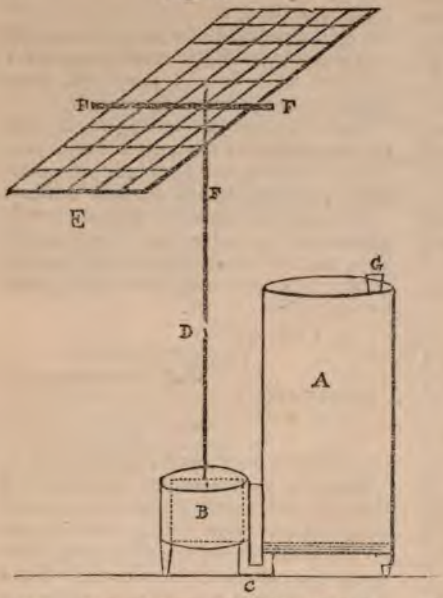
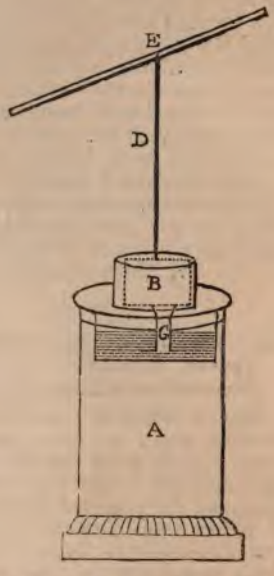


Fig. 2.



Sir,—If you deem the following description of a heat regulator worthy of insertion in your valuable Magazine, I have the permission of the inventor to offer it to you. It appears to be well calculated for preserving atmosphere of hot-houses, hospital-rooms or any others at any desired temperature, and to be particularly applicable to the process of hatching chickens by artificial means, the difficulty of keeping an uniform heat having hitherto been the great obstacle to success in that operation.

Fig. 1 is the regulator in its most simple and economical form as used by the inventor. A is a close cylindrical vessel of tin painted *black*, about 18in. diameter, and 3 ft. 6 in. high. B is an open vessel about 8in. diameter and the same in height, and having its bottom raised on pegs 2in. above that of A. C is a pipe of ¼th in. bore, communicating with both vessels. The dotted lines within the vessel B are a float of any material impervious to water, and nearly filling the whole of the inside of B. D *is a cord, or chain,* attached at one *extremity to the float, and at* the other to *the window or to a part of* a window *in the roof of the hot-house,* or window of a room as shown by E, and which is balanced on the points F F, in such a way, that the weight of the float shall just be sufficient to close the window, but that when that is removed, the window shall open by the then preponderating weight of that end of it opposite to which the cord is attached. Water is poured into the vessel A to the depth of a little more than 2 in., by a cork hole G, which must then be securely closed.

To adjust the apparatus, we will suppose, for instance, the required temperature to be 60. When you find by the thermometer that the place to be warmed has reached that temperature, cork the aperture G securely, and let the float D just touch the surface of the water in B, the window being closed, as soon as the temperature rises above 60, the air in G will expand, and force part of the water from A into B, the float, as the water enters loses a proportionate quantity of its weight, and the window consequently opens. The required temperature being again restored, the air in A again contracts in volume, and admits the water into A, consequently, the float again exerts its whole weight in closing the aperture.

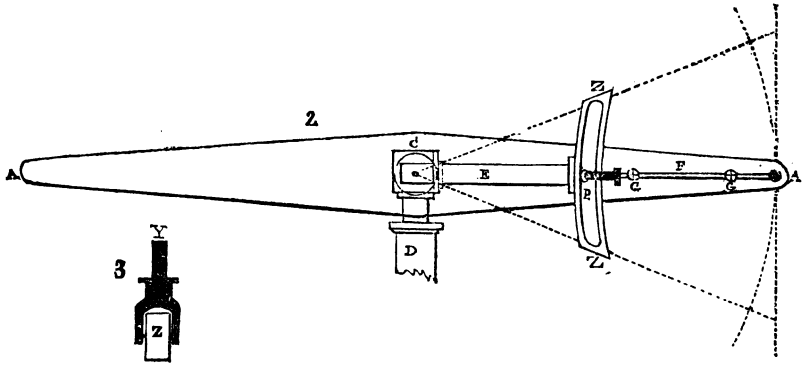
Fig. 2 is a more ornamental instrument, and may be made of cast-iron as a handsome column. The same letters will apply to both figs., but the water in fig. 2, must, on account of its form be placed in a separate vessel H, about 2½ in. deep, in the interior of A, and as near the top as possible, provided the air is not absolutely excluded. The pipe C, connecting this vessel with B, must reach within one-eighth of an inch from the bottom of H.

The cork hole may be dispensed with, and the water introduced through B.

Q.

NEW PARALLEL MOTION.

Fig. 2.



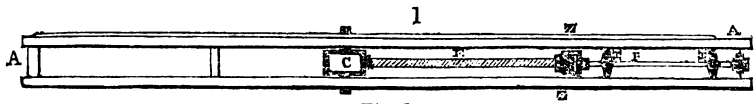


Fig. 1.

Sir,—Should you deem the accompanying description of an invention of mine worthy of a place in your valuable journal, I should feel myself highly honouredby its insertion. It is intended for a new method of obtaining a parellel motion, for a beam engine. It is of a novel construction, but as you will perceive, the principle is the same, as all parallel motions are constructed upon.

It consists of two beams parallel to each other, (see the plan, fig. 1) between which at the centre G and firmly fixed to the support D, fig. 2, (so as to allow the two beams to work freely on either side) is placed the bar E at the end of which is the arc Z Z. The curve of which is the same as that described by the ends of the beams; this arc is hollow, having a passage through its whole length, as shown at fig. 2. The bar F is placed between the beams, and is provided *with two* small cross heads, to keep it midway (see fig. 1.) At the ends of each cross head are two small friction wheels, consequently the bar is only capable of a reciprocal motion. To one end of this bar is fixed the piston rod, the other end is provided with a pair of cheeks, (as shown in the plan, fig. 3) which embraces the axis of a small friction wheel running in the grooved passage of the arc Z Z. Therefore, when the beams rise, the bar F being fixed between them, will rise also, carrying with it the small wheel which runs in the curved passage; which will force the bar forward, so keeping the end at which the piston rod is fixed, in a direct line.

Z Y is the plan of the top of the curve.

I remain, Sir,

Your most obedient,

NICHS. HUGHES.

29, Bishopsgate-street, Without, Nov. 22, 1838.

STEAM CARRIAGES ON COMMON ROADS —THE CAMBRIDGE ROAD.

We extract the following very just remarks upon this subject in reference to Mr. Hancock's letter, which appeared in our Magazine of the 20th ult., from the *Cambridge Independant Press* of August 3rd. :—

The Great North Road.—In reference to this subject, to which we have frequently called the attention of the public, we have been anticipating for some weeks past the arrival of some one trial carriage, constructed under the auspices of the company for steam conveyance on common roads, under the patents of Col. Maceroni, whose advertisements have several times appeared in our columns, on that line of road between London and Cambridge, selected by the provisional managers of the company for the first essay.

We are quite aware of the difficulties arising from the present state of the money market, in getting together the necessary volume of high-pressure steam, in other words, the deposits on shares taken in this company to accomplish, the object in question; and we believe the same observation will apply to any and all public companies brought out lately however clearly and satisfactorily their ultimate pecuniary benefits might be demonstrated. That "hope deferred," however, "maketh the heart sick," is, in this as in all other similar cases, a trite and most true saying. Considering moreover the various discussions that have lately occupied the leading public prints and the house of commons also, as to the desperate and ruinous state of the old turnpike trusts, and the collaterally failing interests of post-masters, coach proprietors, and innkeepers, we are not a little surprised, that from the managing committee of a company expressly formed upon a basis so decidedly national, no really practical result has, as yet, emanated. In spite of the well known tried and acknowledged practical talents of the patentee in the application of the agency of steam to common road conveyance, we are still left to "hope" alone.

In our columns a fortnight ago, we alluded to the fact that there were likely to be three companies or proprietors in the field, viz., Sir James Anderson, Colonel Maceroni, and Mr. Hancock, proposing to supply the public with steam conveyance, under various improvements, on common roads, and thereby to place such roads on a safe, cheap, and satisfactory competition with the railroad system. Our special attention has, in reference to this subject, been called to a letter signed "Walter Hancock," published in the weekly number of the *Mechanics' Magazine* of the 20th of July last. Mr. Hancock's letter appears to be so clearly and impartially written, and exhibits altogether so truthful an aspect, that it becomes our bounden duty to draw the earnest attention of the public in these eastern districts to the whole of his statement. From the managers and solicitors of the company formed under Col. Maceroni's patent, we cannot learn that either the public or the shareholders of the company have received lately any communications, excepting certain extracts of evidence taken before the House of Commons' committee on turnpike roads, of a character similar to that now thrown boldly before the public by Mr. Hancock; who broadly asserts that he is now ready with a carriage built, to prove by deeds, not words, what and how much he can do. To this test, the very best of all others, he wishes the public to put himself and his vehicle.

PRESENT STATE AND PROSPECTS OF THE IRON TRADE.

A paper, "on the state and prospects of the iron trade in Scotland and South Wales, in May, 1839," was read before the Liverpool Polytechnic Society, on the 13th June, by Joseph Johnson, Esq., iron merchant, Liverpool.—The following is an abridgment thereof.

The vast and increasing importance of the iron trade to this country must be so apparent to the most indifferent observer, that I feel fully persuaded I need offer no apology to you for intruding upon your notice the consideration of a subject that appears, at first sight, so completely without the legitimate sphere of the objects for the promotion of which this society was established. The daily increasing magnitude of this branch of British industry is surprisingly great.

The introduction of Mr. Neilson's hot-blast formed quite a new era in the iron trade, and the consequent increase of produce of iron, particularly in Scotland, where this invention was first applied, has been incredibly great, and is still progressing. I have been very kindly furnished by a friend, who is intimately connected with the Scotch iron trade, with a list of all the furnaces now in operation in Scotland, the number out of blast, the number erecting, and about to be erected; I have every confidence in the accuracy of my friend's information, and have no doubt but that the correctness of the list may be relied upon. This list shows that there are in Scotland, fifty furnaces in blast, five out, seven building and twenty-six contemplated. With the permission of the meeting, I will read over the names of the works, and their respective owners.

Names of Works.	Owners.	In Blast.	Out of Blast.	Building.	Contemplated.
Clyde	James Dunlop.....	4	1	—	4
Calder	W. Dixon, and Co...	6	—	—	—
Carron.....	Carron Company....	4	1	—	—
Muirkirk....	Muirkirk Iron Co. ..	2	—	—	—
Devon	Devon Iron Co.	2	1	—	—
Shotts	Shott's Iron Co.....	2	—	1	—
Monkland ..	Monkland Iron Co...	5	—	—	—
Gartsherrie ..	W. Baird, and Co. ..	7	—	1	6
Dundyvan ..	Dunlop, and Co	5	—	1	4
Summerlee ..	Wilsons, and Co....	4	—	—	2
Castle-hill ..	Shott's Iron Co.....	2	—	—	—
Bona	Bona Iron Co.....	1	—	—	—
Govan	W. Dixon, Esq.	2	—	—	4
Wilsontown..	W. Dixon, Esq.	1	—	—	—
Coltness	Mr. Holdsworth	2	—	—	—
Omoa	W. Young	1	—	—	—
Carnbroe....	Alison, and Co.....	—	—	2	4
Galston	M'Callam, and Co...	—	1	—	—
Blair	Mr. J. M'Donald....	—	—	2	—
Housle	Mr. Galloway	—	1	—	2
		50	5	7	26

Supposing the whole of these furnaces to be in full activity by the end of the year 1842, and giving the average produce of 80 tons per week to each furnace, we shall have Scotland alone producing upwards of 360,000 tons of cast iron per year, nearly equalling the make of the United Kingdom twenty years ago. Sixty-five out of eighty-seven furnaces I have enumerated, are situated in or about the Monklands, to the south and south-east of Glasgow, and distant from that city seven to ten miles. The works in that district have the command of the blackband ironstone, the possession of which my informant states to be so great an advantage that without it, the trade would not be worth following. The furnaces in the Monklands, by using this combustible blackband ironstone, may average 100 tons in seven days each, but those which have not this material, do not yield nearly so large a quantity. Therefore, bearing in mind that the Presbyterians stop their furnaces one shift, or nearly twelve hours on each Sunday, we may safely put down the average yield of the furnaces in Scotland at 80 tons per week each.

Three of the largest makers of iron in Scotland are directing their attention to the manufacture of bar-iron, and with every prospect of most complete success. The Monkland Iron Company are erecting mills and forges capable of making 230 tons malleable iron per week. Dunlop, Wilson, and Co., of Dundyvan, are making preparations to enable them, when in full operation, to make 300 tons of bars, &c., weekly, and they will be partially at work in two months. William Dixon, Esq., of Govan Iron Works, has now ready for immediate working, capabilities for producing 200 tons of malleable iron per week. His mills and forges are on the outskirts of Glasgow, and are known as the Glasgow Iron Works, at the Town Head.

The Muirkirk Iron Company have five puddling furnaces, rolling mill, &c., but they are not making more than about 20 tons of bars weekly.

This statement comprises the present, and so far as is known, the prospective operations in the malleable iron trade in Scotland, with the exception of two small forges, the Lancefield and the Gartness, where they puddle a little for white iron.

It was for a long time considered doubtful whether the Scotch cast-iron, made as it is with raw bituminous coal and heated air, would answer for malleable iron, and several experiments have lately been made with a view to ascertain more nearly than had hitherto been done its applicability for this purpose. So far as I have beeen able to learn, these experiments have been attended with most satisfactory results. I was informed a few days ago by Edmund Buckley, Esq., of Manchester, who has for a long time past taken a very lively interest in these matters, that in some trials recently made by Messrs. Beecroft, Butler, and Co., at their works, at Kirkstall near Leeds, they found 4 cwt. 2 qrs. of Scotch pig-iron to yield, by the process of boiling instead of puddling, blooms of 4 cwt. 1 qr. 8 lbs. each, showing only the comparatively trifling waste of 20 lbs. in a charge of 4 cwt. 2 qrs., and the quality of the iron was found to be at least equal to any made with cold air. Indeed many thousand tons of

Scotch cast-iron have been purchased from time to time by the iron masters of South Wales to mix with their own country metal in their puddling furnaces, thus affording unquestionable proof of its fitness for conversion into malleable iron. I have no doubt that we may speedily receive extensive supplies of bar-iron from Scotland, such as we have hitherto received principally from South Wales and Staffordshire.

I must now ask your indulgent attention for a little while longer, and request the favour of your company on a very interesting tour through the mineral districts of the counties of Gloucester, Monmouth and Glamorgan. I class the iron-works of the Forest of Dean with those of South Wales, as well from their proximity to the latter, as from the circumstances of their being worked by those eminent South Wales iron masters, Messrs. Guest, Lewis and Co., and W. Crawshay and Sons. At the "Cinderford" works there are four furnaces, three in blast, and one out, producing on an average from 100 to 120 tons each of excellent forge pig-iron weekly. At the "Sewdley works there are two furnaces, one in and one out of blast, producing about ninety tons of iron per week, and at the Park-end works there are two furnaces, one in blast, and the other out, making about eighty tons per week.

The differences in the produce of furnaces may be accounted for in a variety of ways; some are larger than others, some have superior blowing engines, and others may be under better management. The furnaces I have named are all that are on the Forest of Dean; but large quantities of iron are raised here, and are sent, as well as the iron, to different works in South Wales and Staffordshire. The shipments are made at a wharf a little below Newnham.

Leaving the forest, we will proceed to Newport. Here you will find a most excellent river navigation – the Usk, and at all seasons of the year may be seen large numbers of vessels, of various tonnage, waiting to receive the mineral produce of Monmouthshire, in the shapes of coal and iron. Having viewed the port, and noted all its facilities for shipment, and especially the magnificent dock now constructing for affording to the shipping increased conveniences, we will, if you please, proceed to the interior of the county, and notice the various works in the order in which we reach them.

The first works we arrive at are those of Capel Hanbury Leigh, Esq., near Pontypool, and are called the Pontypool Iron Works. Here you will find three furnaces in blast, and one out; two blown with cold air, and one with hot. There are not any furnaces erecting, or about to be erected here. The make of these three furnaces is about 300 tons per week. The hot-air pigs are sold chiefly for foundry purposes, and the cold air iron is used by Mr. Leigh, for tin-plates, of which he has been for a long time past a very eminent maker. The yield of the iron-stone at these works is about 30 per cent.; bnt Mr. Leigh imports large quantities of the richer ores from Lancashire and Cornwall, for the improvement of the quality of his iron.

A little further up the valley we reach the works of the Pentwyn and Golynos Iron Company, where you will find five furnaces all in blast, and one about to be erected; three are blown with hot air, and two with cold. The produce of the five furnaces is about 450 tons per week. They have just completed first rate forges and rolling mills, calculated to make 350 tons of bar and other malleable iron per week. About a mile above these works, you find those of the British Iron Company, at Abersychan. Here are four furnaces in blast, all blown with cold air, and two out of blast. The four make about 380 tons of pig-iron per week, from which they make about 270 tons of malleable iron, and the remainder is made into castings, &c.

We next arrive at the Varteg Iron Company's works, where you will find five furnaces all in blast, four blown with hot, and one with cold air. They produce about 350 tons of pig iron per week, from which they make about 160 tons of bars and rails, about twenty tons of castings for engine uses, &c. and the remainder is sold for foundry purposes.

Pursuing our course for two miles further up this valley, we arrive at the works of the Blaenavon Iron Company, where we find five furnaces all in blast, blown with cold air, and six others erecting. This mineral property, I am told, is one of the best and most valuable in the county of Monmouth, and these works have been long distinguished for the superior strength, and general excellence of their iron. These five furnaces produce about 400 tons of cast iron per week, about one-half of which is refined, and part of it made into cable iron, and the remainder is sold for tin plates and foundry work. This company are erecting extensive forges and rolling mills, and will, in a few years, contribute largely to the supply of bar iron and rails.

We have now arrived at the extremity of the first valley, and, crossing the mountain, we will descend to Abergavenny. The rolling mills on the left-hand side are those of the Garndyrris Iron Company, and have

been worked for many years by the late firm of Messrs. Hills and Wheely. They are now united to the Blaenavon Iron Works, and are carried on by the same company.

We next reach the works of the Clydach Iron Company, at Llanelly. Here are four furnaces at work, and all blown with cold air. They produce about 320 tons of pig-iron per week, from which they make about 230 tons of bars, &c., and the remainder is run into castings and ballast iron.

The Nant-y-glo Works are the next we arrive at, situated, as their name imports, in the Valley of Coal. Here, some years ago, was expended upwards of 50,000*l.* in attempts to establish a profitable iron work, but without success; and not until the property was purchased by the present talented and enterprising proprietors, Messrs. Joseph and Crawshay Bailey, was any remuneration realised. These works now rank amongst the very first class. Messrs. Bailey have, within the last few years, purchased the Beaufort Iron Works. At the two establishments they have fourteen furnaces in blast, ten blown with cold and four with hot air, and I am informed that they intend erecting four others very soon. Their make of pig-iron is from 1,200 to 1,300 tons per week, from which they make about 750 tons bars, rails, and rods, and the remainder is sold for foundry purposes.

Near the Nant-y-glo works, and situated in the same valley, are the Coalbrook Vale Company's works, consisting of three furnaces, all blown with cold air, and another is about to be erected. The make of the three furnaces is 160 to 180 tons of cast-iron per week, all of which they make into castings, or dispose of for that purpose.

A mile lower down this valley you reach the Blaina and Cwm Celyn Iron Company's iron works. These two properties have recently been purchased by a joint stock company, and promise well for their proprietors. Messrs. Russell and Browns, the former proprietors, are the managing directors. At Blaina they have two furnaces in blast, and one about to be erected, all blown with cold air. They yield about 120 tons of pig-iron per week, which is nearly all made into castings on the spot. At Cwm Celyn they are building four furnaces, the entire produce of which is to be made into malleable iron.

We have now finished our inspection of the works in the second valley, and will proceed to the third, which is called EbbwVale, from the river Ebbw flowing through it.

The first works we reach are the Beaufort, which I have already informed you belong to Messrs. Bailey, and their produce I have *included in the return* for Nant-y glo.

Proceeding onwards, we arrive at the Ebbw Vale works, the property of Messrs. Harfords, Davies, and Co., who are also the owners of the Shirhowey iron works, situated in the next valley. At Ebbw Vale they have three furnaces in operation, and are building a fourth. They blow one furnace with hot, and two with cold air. These furnaces are very productive, yielding 100 tons per week each. At Sirhowey, they have four furnaces in blast, and one undergoing repairs; two are blown with hot, and two with cold air. These furnaces also make about 100 tons per week each, so that at the two works they make about 700 tons of cast-iron weekly; the whole of which is converted into bars, rails, and rods. Their make of malleable iron is from 600 to 630 tons per week.

One mile lower down the Ebbw Vale, you will find the Victoria Iron Works, recently established under the able superintendence of Roger Hopkins, Esq. These works belong to the Monmouthshire Iron and Coal Company. Only one furnace is yet at work, but another is ready to be blown in, and they are erecting two others. They have just commenced the manufacture of bar-iron. I have been informed that they intend building ten additional furnaces lower down the valley, near to Abercarne. When in full operation, they calculate on making 1,000 tons of wrought or malleable iron per week; but this expectation will probably require a few years for its accomplishment.

Having seen all the works in the third valley, we proceed to the fourth, and we here find, first, the Sirhowey works, to which I have already alluded, and next to these, the works of the Tredegar Iron Company. At Tredegar, they have five furnaces in operation, all blown with cold air; they are building two others, and contemplate the erection of two more, making nine altogether. They now produce 400 to 450 tons cast-iron weekly, which is nearly all made into bars, rails, and rods; of these they make about 330 tons per week.

We must now travel on to the fifth valley, in which we find only the Rhymney and Bute Iron Works, belonging to the joint-stock company of that name. This is a very extensive and most valuable mineral property, and these works bid fair very soon to rival the largest establishment in South Wales. They have now six furnaces in blast, two blown with hot, and four with cold air; and they are building four others. They make about 550 tons pig-iron per week, from which they produce 450 to 480 tons malleable iron in the same period of time.

The whole of the works we have visited

since we left Newport, send their iron to that port for shipment, and it is conveyed chiefly down tramroads by locomotive-engines, and by canals.

We must now take a stretch of five or six miles to the westward, and this will bring us to the hitherto unrivalled establishment of Sir John Guest, Lewis, and Co., at Dowlais. Here you will find fifteen furnaces in full activity, and four others building. I find that I have omitted to note how many were blown with hot, and how many with cold air, but if my memory serves me correctly, I think five with the former, and ten with the latter. These fifteen furnaces make on an average 1,350 tons of pig-iron per week, nearly the whole of which is converted into malleable iron, say about 1,000 tons bars, rails, and rods per week. At this establishment they employ upwards of 4,000 hands.

The next works we reach are those of the Pen-y-darran Iron Company. They have six furnaces in blast, and one out, making about 400 tons to 500 tons cast-iron per week, and they convert nearly the whole of it into malleable iron, of which they produce abont 400 tons per week. I believe the whole of these furnaces are blown with cold air.

We have now, gentlemen, performed a very good day's work, and I am sure you will heartily join me in a proposal to take up our quarters for the night at the Castle Hotel, Merthyr Tydvil, where I give you my word that you may make yourselves comfortable, if you choose. You must take care to muster for breakfast at eight o'clock to-morrow morning, and at nine we will go to see Mr. Crawshay, who is a very early man of business.

The preparations of the morning over, and our arrival having been announced at the Cyfarthfa office, we are now on our way to see the Cyfarthafa Iron Works, belonging to Messrs. Crawshay and Sons, and shall no doubt be willingly accompanied by Mr. Williams, their talented engineer. These works are in my opinion the neatest and best arranged in all South Wales, and Mr. Williams I am sure will have pleasure in showing you the whole of the machinery. Amongst other interesting objects for your attention, you may here see the largest pump I ever heard of. The diameter of the working barrel is six feet, and the length of the lift in the barrel is four feet. It pumps up the whole of the river Taff, and the water, after turning all the wheels about the works, is discharged ino the bed of the river. This *may appear*, at first view, an expensive way *of obtaining power; but experience* shows *that it is cheaper than erecting* a number of *small engines, or transmitting* power through complicated machinery. Besides the Cyfarthfa, Messrs. Crawshay have the Hirwain works, which are situated about some six miles from Merthyr. At the two establishments there are in the whole fourteen blast furnaces, twelve at work, all blown with cold air, and two in operative. They make about 900 tons of cast-iron per week, and the greatest part of it is made into malleable iron, of which they produce 600 to 650 tons per week.

We next visit the Plymouth Iron Works, belonging to Messrs. Richard and Anthony Hill. Here are seven furnaces, all in blast, and all blown with cold air, making 700 tons of cast-iron per week on an average, and from which they make about 600 tons into bars, &c. weekly.

About six miles from Merthyr, over a mountain, are situated the works of the Aberdare Iron Company. They have six furnaces in blast, two blown with hot, and four with cold air, producing 350 to 400 tons cast iron per week. They make about 220 tons bar-iron per week, and the remainder of their produce is disposed of for foundry purposes.

At the Pentyrch Iron Works, near Cardiff, there are two furnaces in blast, blown with cold air, and making about 150 tons cast-iron weekly.

The whole of the iron made at the seven last-named works is shipped at Cardiff, where a very commodious dock has recently been constructed by the Marquis of Bute, under the superintendence of William Cubitt, Esq., F.R.S., C.E., for the better accommodation of vessels entering that port. * * *

There is another branch of the statistics of the iron trade on which I felt desirous of affording you some information, and in obtaining this I have been somewhat more successful, though it was not procured without very great difficulty—I mean the proportions of the mate ials used in each process, and the waste of the iron. I am glad to say that I can inform you on these most important points with the utmost exactness. Fifteen furnaces, averaging ninety tons each per week, will produce 1,350 tons of cast-iron with a consumption of 50 cwt. of coal per ton of iron, inclusive of calcining—say 3,375 tons of coal to furnaces and calcining, and to the blowing engines 10 cwt. of coal per ton of iron, or 675 tons. If the furnaces make 1,350 tons of cast iron, 100 tons may be deducted for ballast iron. Then refining 1,250 tons, at 22 cwt. 1 qr. of pig to the ton of refined iron, will produce 1,110 tons refined metal with a consumption of 9 cwt. per ton, or about 500 tons of coal weekly for the refineries. 1,110 tons re-

fined metal will yield of puddled iron, at 21 cwt. per ton of the metal, and 18 cwt. of coal per ton of iron, 1,045 tons, with 940 tons of coal; and then the rolling-mills, at 22½ cwt. of puddled iron and 20 cwt. of coal per ton, will produce 915 tons of merchant bars, or what is called No. 2 iron with a consumption of 915 tons of coal. * *

Within the last three years, Mr. George Crane, of the Yniscedwyn iron works, has discovered, that by using heated air, he can melt iron ores with the anthracite coal. When I was last in South Wales, I visited Mr. Crane at his works, near Swansea, in order that I might see and judge for myself of the merits of this discovery. To enable you to form some idea of its value and national importance, I need only inform you that it has added to the available resources of this kingdom, for the purposes of its iron trade, a district sixty to seventy miles long, by six to eight miles broad, abounding with the anthracite or carbon coal, lime, and iron-stone; and further, that it has already trebled the value of this extensive mineral property. The third annual report of the Swansea Philosophical Literary Institution, for the year 1837, in alluding to Mr. Crane's discoveries, states:—"The benefits likely to arise from this valuable discovery will be most extensively felt, but it will nowhere be found of more immense importance than in our own neighbourhood; for it will be the means of opening to commercial enterprise a portion of our extensive coal-field, which though abounding in the metal pronounced the most useful to man, has hitherto been excluded from the influence of that ingenuity, by which he moulds it to his will." * *

This new feature in the iron trade soon attracted the attention of capitalists, both here and in London; and the counties of Pembroke, Carmarthen, and the western part of Glamorgan, give fair promise soon, at least, to rival Monmouthshire and the eastern part of Glamorgan, in the manufacture of iron. I will first enumerate the works already in operation in the Swansea and Neath districts, and then inform you of the extent to which new establishments are being erected and others contemplated.

The Maesteg iron works are worked by Messrs. Robert Smith, and Co., with bituminous coal and hot air; they have two furnaces at work, producing from 180 to 200 tons per week of cast-iron. A part of this they make into malleable iron, but I am not aware of the exact quantity—perhaps, about 60 to 70 tons per week.

The make of Mr. Crane, at the Yniscedwyn iron-works, I have already acquainted you with.

The Neath Abbey Iron Company have two furnaces in blast, blown with heated air, and fired with three-fourths bituminous, and one-fourth anthracite coal. They make about 160 tons of cast-iron per week, the chief part of which is made into castings on the spot, for their very extensive engineering establishment.

The Millbrook Iron Company have two furnaces in blast, producing about 40 tons per week, blown with cold air.

The works erecting in the anthracite district are the Venallt, in the vale of Neath, and belonging to our enterprising townsmen, Messrs. Jevons and the Messrs. Arthur, of Neath. They are carried on under the firm of Jevons, Arthur, Wood, and Co. They are building two furnaces, and hope to be in blast by the end of the year. They have a very abundant supply of both kinds of coal and ironstone.

The Ystal-y-fera works, near Swansea, are also being erected by a Liverpool company, at the head of which stands our spirited and excellent fellow-townsman, Sir Thomas Brancker. This company is building four furnaces, and I am told that they intend building four more. Their fuel is all of the anthracite kind.

The Cambrian Iron Company are erecting four furnaces near Pile, on bituminous coal, and I have been informed intend building four furnaces in the anthracite district.

Messrs. Mellins and Co. have one furnace near Pile.

The Gwendrath is a new work about to be established by a London company, near Swansea, but I could not ascertain the extent to which they intend going. Mr. Crane informed me that he knew of twelve to fourteen new iron works, of from two to eight furnaces each, erecting, and about to be erected, in the anthracite district, the existence of which will be solely attributable to his invaluable discovery.

The aggregate number of furnaces in blast in South Wales we have found to be 122; out of blast, 7; building, 31; and contemplated, 91; and, allowing for the twelve works that Mr. Crane alludes to, as being likely to be erected soon, only five furnaces each, or sixty in all, we thus find that probably within the next five years the number of furnaces in South Wales will be doubled, and number 244. Allowing an average produce of 80 tons per week for each furnace, we have the astounding quantity of 1,015,040, or, in round numbers, 1,000,000 tons of cast-iron produced in this district alone—a quantity equal to that produced last year in the whole of Great Britain.

NOTES AND NOTICES.

Thomas Tredgold.—To architects, engineers, and persons concerned in any department of building, the name of Tredgold must not only be familiar, but likewise respected and valued: and it is presumed not less so by many individuals in the higher walks of life. To all such it must be a matter of painful interest to be informed, that the family of such a highly-gifted man and martyr to science, consisting of an aged mother, two daughters in extremely delicate health, and a son of about thirteen years of age, are in very dependent circumstances. His friends have long cherished the hope that before his time—for it is now ten years since his death—their situation might have attracted the favourable notice of government; but as this has not been the case, Mr. Habershon, one of his early friends and his biographer, with John Donkin, Esq., his joint executor, have commenced a subscription in furtherance of this laudable object.—Z.

Drainage of Lands by Steam Power.—The drainage of land by steam power has been extensively adopted in the fens of Lincolnshire, Cambridgeshire, and Bedfordshire, and with immense advantage. A steam-engine of ten-horse power has been found to be sufficient to drain a district comprising 1,000 acres of land, and the water can always be kept down to any given distance below the plants. If rain fall in excess, the water is thrown off by the engine; if the weather is dry, the sluices can be opened and the water let in from the river. The engines are required to work four months in the twelve, at intervals varying with the season, where the districts are large; the expense of drainage by steam power is about 2s. 6d. per acre. The first cost of the works varies with the different nature of the substrata, but generally it amounts to 1*l.* per acre for the machinery and buildings. An engine of forty-horse power, with scoop wheel for draining, and requisite buildings, costs about 4,000*l.*, and is capable of draining 4,000 acres of land. In many places in the fens, land has been purchased at from 10*l.* to 20*l.* per acre, which has been so much improved by drainage, as to be worth from 60*l.* to 70*l.* per acre.—*Durham Advertiser.*

New Alloys of Metals.—A curious and valuable discovery has just been made in the alloy of metals. A manufacturer of Paris has invented a composition much less oxidable than silver, and which will not melt at less than a heat treble that which silver will bear; the cost of it is less than 4d. an ounce. Another improvement is in steel; an Englishman at Brussels has discovered a mode of casting iron so that it flows from the furnace pure steel, better than the best cast steel in England, and almost equal to that which has undergone the process of beating. The cost of this steel is only a farthing per pound greater than that of cast iron.

Machine for copying Oil Paintings.—M. Liepmann, a painter of eminence at Berlin, is stated to have invented a mechanical process for taking, in a very short time, a copy of any painting in oil, however old, with an exactitude which cannot be attained by the brush. M. Liepmann has exhibited his machine in the galleries of the Royal Museum at Berlin, and in the presence of the directors, made 110 copies of a portrait of Rembrandt, with the greatest success.—*Morning Herald.*

Whole Number of Steam-boats, Locomotives and other Steam-engines.—The whole number of steam-engines of every kind in the United States, reckoning one to each boat, is ascertained and estimated to be 3,010. Of these, 2,653 have been ascertained, and 357 are estimated, in places from which the returns are either defective, or not received at all. Of this whole number, about 800 are supposed to be employed in steam-boats; of which 700 are ascertained, and 100 estimated. About 350 are employed in locomotives on railroads, of these 337 are ascertained, and 13 estimated. The residue, being 1,860, are used in manufactories of various kinds; of these, 1,616 are ascertained, and 244 estimated.—*Government Report.*

Improvement in Gloves and Stockings. — The hosiers of Nottingham and Leicester are making gloves and stockings having bands of India-rubber web knitted at the wrists, and under the knees instead of garters; a patent has been obtained for the invention, and licences, at £5 a-year each, are sold to the frame-work knitters.—*Nottingham Review.*—[In the Rolls Court on Saturday last an injunction was applied for by the London Caoutchouc Company—as the proprietors of Sievier's patents, to restrain these Nottingham manufacturers from using the elastic web in this way. The matter was partially compromised by the infringers paying the patentees 10*l.* as an acknowledgment of their right—and on being permitted to sell the stock of gloves and stockings they had on hand.]

Discovery of Mummies at Durango, Mexico.—A million of mummies, it is stated, have lately been discovered in the environs of Durango, in Mexico. They are in a sitting posture, but have the same wrappings, bands and ornaments as the Egyptains; among them was found a poignard of flint, with a sculptured handle, chaplets, necklaces, &c., of alternately coloured beads, fragments of bones polished like ivory, fine worked elastic tissues, (probably our modern India rubber cloth,) moccasins worked like those of our Indians, bones of vipers, &c. It is unknown what kind or embalming was used, for the mummies above mentioned, or whether they were preserved by nitrous depositions in the caves where they were found. A fact of importance is stated, that necklaces of a marine shell are found at Zacatecas, on the Pacific, where the Columbus of their forefathers probably therefore landed from Hindostan, or from the Malay or Chinese coast, or from their islands in the Indian Ocean.—*Silliman's Journal.*

Anthracite Coal. — An Association has been formed in South Wales, the object of which is to demonstrate the applicability of anthracite coal to those purposes to which it has been but partially applied, and to make the properties of this description of fuel more generally known and appreciated. The success which has attended the experiments and actual working at the furnaces of Mr. George Crane, at the Yniscedwyn iron works, near Swansea, doubtless, first attracted attention to the use of anthracite or stone coal in this country to any extent, thus rendering of importance here a mineral which had been before held compasatively as valueless. We are aware that, before the application of stone coal in this country. America took the lead in its use in steam-boats, and also for domestic purposes—the quantity of carbon which it contains giving out a greater heat than that description of coal where combustion is more rapid. Whether stone coal is used in our steam-boats as mixed with other we are uncertain, but we have been informed, by practical engineers, that there can be no doubt of its being found to answer. Experiments have been made, both with marine and locomotive engines in this country, as also with those employed in manufactories, although but little advance has yet been made in its introduction. Much, we think, depends on the liberality displayed by the owners of anthracite coal property, and the means they take for its introduction, which, in all cases with a new article, has not only to surmount prejudice, but to meet with the opposition of those who occupy the market, and who would be supplanted by the introduction of a new material—*Mining Journal.*

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 164, Fleet street.*—*Sold* by A. & W. Galignani, Rue Vivienne, Paris.

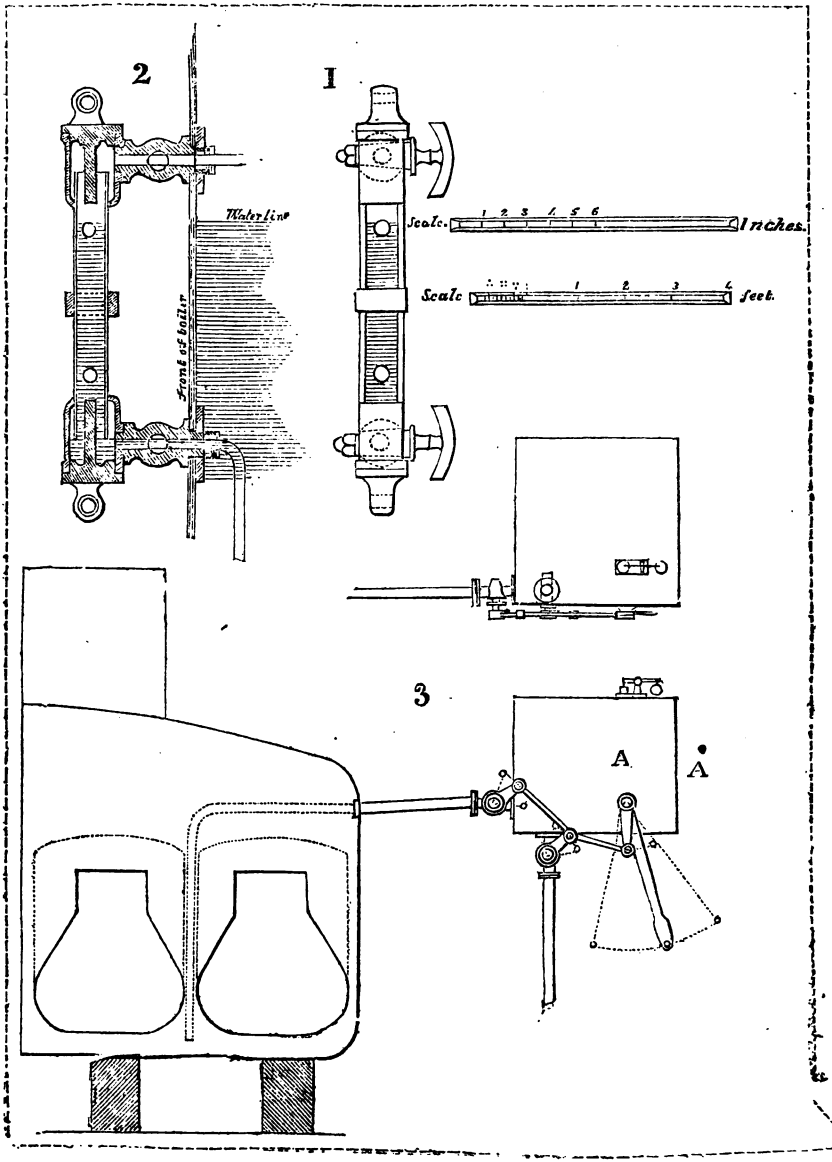
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 836.] SATURDAY, AUGUST 17 1839. [Price 6d.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

SEAWARD'S SALT GAUGE AND SALT DEPOSIT PREVENTION APPARATUS.



MR. S. SEAWARD'S PATENT METHODS FOR THE PREVENTION OF SALINE DEPOSITS IN MARINE STEAM-BOILERS.

The present method of blowing out, as it is termed, or, in other words, discharging the brine from boilers, is extremely uncertain and ineffectual. It consists simply in turning open the cock of a pipe or tube which leads from the bottom of the boiler through the ship, either at the bottom or low down the side. When a steamer has gone some distance on a sea voyage, it is customary with the engineer to have a blow out, on the presumption that the water *must* have become so salt as to have produced a large deposit. But he has no means of knowing how the fact really stands; he proceeds on conjecture entirely; and can, therefore, hardly miss discharging either too much or too little. At one time he will suffer two, at another four or even six inches of the body of water in the boiler to flow out (the exact quantity cannot well be known, for this depends upon the shape of the boiler and the extent of surface of water) when perhaps half the quantity in each case would suffice. And this chance sort of operation he repeats every two, three, or four hours, according as his fancy dictates. If eventually he saves his boiler from getting salted during the voyage, *i.e.*, injured by the deposit of salt, he considers he has worked his vessel to admiration, although in point of fact he may have blown out six times more than was necessary to produce the required effect. The consequence of all this is an enormous excess in the expenditure of fuel, as all the water so blown out is at the boiling point of salt water, under the pressure of the safety valve—say 226 degrees.

Again, if following a different and more negligent course, he does not blow out enough, salt will begin to be rapidly deposited, and in a very short time the whole of the lower part of the boiler will be filled with salt, and then destroyed, for the salt preventing the water from coming in contact with the sides and tops of the flues, the fire quickly penetrates through them, they become red *hot, and split to pieces.*

Should, moreover, the engine man *leave the blow-cock open, for only a few minutes beyond the usual time,* (a thing of common occurrence) then the water descending below the flues and furnaces, leaves them uncovered, they become at once red hot, and the boiler is damaged to such an extent as to render its removal absolutely necessary.

To remedy these serious evils, which have unquestionably been a source of great loss to steam-boat owners, Mr. S. Seaward has invented and patented two contrivances of a very ingenious and philosophical character, and of such certain efficiency that they cannot fail to come into universal use.

The *first* is a gauge or meter, represented in the prefixed engraving, figs. 1 and 2, which indicates to the eye the degree of density of the water in the boiler, after the same manner as a mercurial gauge indicates the degree of pressure.

A strong glass tube of about ⅞ths of an inch bore, and 14 inches long, is firmly fixed at each end in a brass frame, to which are attached four cocks, one at each end, and two at the sides. By the two latter, or side cocks, the instrument is attached to the front of the boiler, and fixed at such a height that the water-line in the boiler may show its level in the glass tube. On opening the side cocks, the water rises up from the bottom of the boiler by a pipe attached to the lower cock, to the same level as the water in the boiler. These cocks being then closed, the upper one of the two others is opened, and two metallic, or glass balls are dropped into the tube,—the first ball graduated to one degree above the density which it is desired the water in the boiler should maintain—the second ball graduated to one degree below. The upper cock is then closed, and the two cocks communicating with the boiler left open. Now, as salt-water increases in weight or density just in proportion as it holds more or less salt in solution, it follows, that when the water in the boiler is at the degree of saturation desired to be maintained, the lighter ball will float at the water-level, and the heavier ball rest at the bottom,—and further, that any change of density whatever will alter the position of the balls. For example, on the water becoming more saturated, the lower ball will rise, and on its becoming more diluted the upper one will sink; so that even the slightest change must become apparent.

Whenever the balls begin to change their relative positions, this at once indicates that the operation of periodically discharging the brine should be commenced, but so sure as these remain without alteration in this respect, so sure can no injury happen to the boiler.

The balls are adjusted according to the following table; it being assumed that common sea water contains $\frac{1}{32}$ of its weight of salt (which is about the general average).

No. 1	$\frac{1}{32}$	nd, or sea-water	boils at	222°
2	$\frac{2}{32}$	do.	do.	224°
3	$\frac{3}{32}$	do.	do.	225°
4	$\frac{4}{32}$	do.	do.	226°
5	$\frac{5}{32}$	do.	do.	227½°
6	$\frac{6}{32}$	do.	do.	228°

It is found that sea-water may be worked without inconvenience when it contains as much as $\frac{6}{32}$ parts of salt (represented by the ball No. 6) but that when the quantity exceeds that, a most injurious deposition begins to take place.

The upper and lower cocks enable the engineer to change and cleanse the balls when required; the bores of each cock being equal to the size of the balls.

The *second* of Mr. Seaward's inventions consists of a method of maintaining the water in the boiler at any degree of saturation desired.

There is a vessel A, fig. 3 of iron, or other suitable material, capable of bearing a strain equal to the pressure of the steam in the boiler, and capable of containing about $\frac{1}{10}$th of the whole of the water in the boiler; this vessel, or receiver, is placed in any convenient position in the engine-room above the level of the water in the boiler, and at such a height from the bottom of the ship, that any fluid contained in it, may by its own gravity, be discharged either into the sea, the bilge, or into the suction-pipe of the bilge-pump. To this receiver is attached a cock and a pipe leading therefrom down through the interior of the boiler to within three inches of the bottom. Another cock is also placed at the bottom of the said vessel, with a pipe leading to the bilge or through the ship's side to the sea as the case may be. Now these two cocks are so constructed and attached together, working by the same handle, that only one cock can possibly be open at a time, so that there never can be any direct communication from the boiler to the discharge-pipe. (A single 3-way cock may be so constructed as to answer the purpose of two distinct ones.) When the salt-water in the boilers, after having been at work some time, has arrived at that degree of saturation or density intended to be maintained, or not exceeded, as indicated by the balls before described, the feed water to the boiler must then be augmented, and the cock leading from the boiler to the receiver opened by the handle, which simultaneously closes the other cock. The saturated water from the bottom of the boiler then rises up and fills the receiver by the pressure of the steam, when the cock is closed.

The object of causing the water to ascend into the chamber instead of descending in the ordinary way, is to prevent the possibility of the pipe ever becoming choked, by the scale of the boiler, or other matter, falling into it; which is often the case with the present plan of blowing out—by which the pipes are soon rendered useless. A small valve placed at the top, or a pipe leading from thence and bent like a syphon, and leading into the ash-pit, will always indicate when the receiver is full, and will also admit air when being emptied.

Now, when the water in the boiler has regained its level, that in the receiver may be discharged into the bilge, by opening the lower cock, which being closed, the receiver may be again filled by the other cock, and discharged as before. If, after one or more discharges, the balls in the glass tube continue to retain their relative positions, that is—one at the bottom and one on the surface of the water, it is then evident that the proper degree of saturation is being maintained; but, should the lower ball rise to the upper one, that will denote an excess of saturation; if, on the other hand, the upper ball sinks to the lower one, it will show an excess of dilution, and the discharges by the receiver must be varied accordingly. By a proper observance, therefore, of the position of the balls in the glass tube, the water in the boiler may be maintained at the degree of density required, and no danger, by incrustation of salt, can possibly ensue, however much the degree of saltness of the water may vary in which the vessel swims.

Mr. Seaward further suggests,

that a coil of pipes may be placed within the receiver, through which the feed water for the supply of the boiler may circulate, by which means almost the whole of the superabundant heat of the discharged brine will be abstracted, and again returned into the boiler along with the feed water.

POPULAR REMARKS ON THE PRESENT STATE OF THE MEANS OF PROPELLING VESSELS BY THE AID OF STEAM.

In the commencement of steam navigation it was fortunate for its rapid developement that the originators of it lighted upon so simple and efficient an instrument as the common under-shot water-wheel, for had they made use of any one of the many substitutes which have since been proposed for this machine, it is most certain that the extension of this species of navigation would have been considerably limited, if the entire abandonment of it for a time had not been the result.

But this instrument, however well adapted for steam navigation in its infant state, was, it would seem from the numerous efforts made to provide a substitute, early considered to be very imperfect in its action; and though it cannot be doubted that its imperfections have by some been too highly rated, a careful investigation of its mode of operation will most indisputably establish the existence of many defects which it would be extremely desirable to remove.

It is not intended in these observations to enter upon an historical account and examination of the numerous substitutes which have, at various times, been proposed for the common paddle-wheel, because, among other objections, it would necessarily require a large space wherein alone to catalogue the plans. Suffice it for the present purpose to say, that it has been suggested to propel vessels by air, and by water, forced from within the vessel, by fins, in their action resembling those of fishes; by combinations of oars; by rods and racks with boards at one of their extremities; by chains fitted up with boards passing round rollers or wheels; and by cranks also fitted with boards: but all of these, *though* in some instances displaying much knowledge and inventive genius, are liable to so many objections, or are altogether so ineffective, as to supersede any idea of their adoption at the present day.

In addition to these plans it has been proposed to retain the framing of the common wheel, but to make alterations upon the manner of arranging the float boards of it; by making these moveable in various ways, by shaping them differently, by dividing them after various fashions, and by placing them so as to form different angles with the framings of the wheel; and it has also been suggested to use the screw under various forms. It is among such alterations of the wheel or applications of the screw that anything like a competitor for the common wheel can alone be found; and it is purposed presently to make a few remarks upon some selections from these two classes of substitutes; but previously it may be considered applicable to make a few observations upon the nature of a perfect propelling instrument; and afterwards it is intended to examine how far the common paddle-wheel, some modifications of it, and some applications of the screw comply with the conditions necessary to such an instrument.

Common experience and a slight acquaintance with the fundamental laws of mechanics alike teach us that a force to be most efficiently applied for the purpose of producing motion in any desired direction, can never be so profitably exerted as when it is applied in a direction precisely corresponding with that in which motion is required to be produced; and we also find that if we apply force in any other than this direction, a part of the force is wasted, either in producing motion in a direction different to that in which it is desired to be produced, or by reaction and being completely neutralized, produces no motion whatever. These results, as far as mechanical science is concerned, lie so near the surface that a very small portion of industry or application is only necessary to their possession; but if one may judge inventors generally by their productions, it does not appear that they think these results, though so highly valuable, worth the trouble of attaining; or they imagine that some peculiar property their inventions possess is so desirable as to justify them in totally disregarding the

application of force in the most effective manner.

From what has just been observed, it is clear that if there existed any machine by which force could be applied in a continuously rectilineal direction, such a machine would be that which should be employed; but mechanical contrivance does not present to our notice anything at all of this kind of a practical character. In default of such a machine, we have recourse to one which makes an approach to it, as in the application of the common paddle-wheel. The path in the water of a paddle of such a wheel, when the vessel is at rest and the wheel in motion and not greatly immersed, is not very far from a straight line; but when the vessel has attained its maximum speed, the wheel being also immersed to the extent required for practical purposes, the nearly straight line takes the form of part of a loop, in which the descending and ascending directions greatly preponderate over the rectilineal one.

Under ordinary circumstances, when a paddle of a common wheel enters the water, the surface of it is inclined to the surface of the water at an angle of about 45°, and as its motion at the same time is in a downward direction, it is very evident that any power imparted to it is applied in a very improper manner, because, in order to produce the best effect, the motion of the paddle should be in that direction which is at a right angle to this direction, or, in other words, in a direction exactly the reverse of that in which the vessel to which the wheel belongs is moving. The inclination of the surface of the paddle, though at this moment beneficial, would be, if the paddle were operating rectilineally in the most proper direction, very objectionable. As the paddle advances in its path, its direction is more and more assimilated to a right line in the most proper direction; until, when having reached the lowest point of its passage, its motion is exactly in this direction, at which point any force applied to it is productive of as much beneficial effect as is possible under the circumstances of the case, because no power is here wasted but that portion which the yielding nature of the water as a resisting medium renders irremediable. The paddle, in passing from this point, again wastefully consumes power, because in its passage to its point of emersion, it more or less exerts its force in an upward direction, and, consequently, as may be inferred from what has been before stated, in a direction very wastefully ineffective for the purpose of propelling the vessel.

If we now suppose a case in which five paddles of a wheel are immersed, one of them being at the lowest point of the wheel, and also suppose, for argument sake, the resistance of the water to be the same upon each of these paddles, and by the process in mechanical science, to which allusion has before been made, represent this resistance by a line of a certain length, placed perpendicularly against the resisted surface of each paddle, we may, except in the case of the lowest paddle, resolve the force of this resistance into one force sometimes, as the case may be, tending to raise, and sometimes to depress the vessel, and also into another force capable of propelling the vessel; and it will be found that the line which represents the propelling force will be shorter as the paddle is further from the lowest point of the wheel, and longer as it is nearer this point; but in the case of the lowest paddle, no such resolution of the force of resistance is practicable, because the line representing the resistance is, in this case, in exactly the direction in which the propelling force should be: as a consequence of this coincidence of direction, there is no force acting upward and downward and tending to raise or depress the vessel, in this case of the lowest paddle. Now, by so much as the line representing the propelling force in any case is shorter than the line representing the resistance of the water, by just so much is power wasted from the manner in which it is applied.

Theoretically considered, it would therefore be desirable to make the water give all its resistance to a paddle at the very instant in which it was at the bottom of the wheel, and cease to give resistance at the moment in which it departed from such a point. But, practically, this is impossible, and consequently endeavours have only been made to modify the objectionable character of the common paddle-wheel.

In one modification of this instrument the large paddles have been replaced by

a series of paddles of small radius, placed in such a curve that at the moment the outermost paddle of each series is entering the water, all the others of the series are in rear of it; and as the series gradually enters the water, the paddles in rear slide, as it were, from behind the foremost paddle, and become more and more exposed to the fullest resistance of the water, until having arrived at the lowest point of its passage, the whole series is exposed to this resistance; from this point the paddles of the series further separate, leaving spaces between them, until they pass out of the water. This beautiful change in the quantity of surface exposed to the full action of the water is not effected by any part having independent motion, but solely from the method of placing the paddles of each series upon the wheel, and arises from the curve in which they are placed upon the wheel, sometimes coinciding in direction with the curve, which a particular part of the paddle-wheel describes, and at other times varying very considerably in direction from this curve, every small paddle being as immoveably fixed to the wheel as each large paddle is in a common paddle-wheel.

This plan, which has been patented by Mr. Elijah Galloway, and was originally invented under a modified form by Mr. Field, attains the desirable end of apportioning, in a great measure, the quantity of surface of paddle, exposed to the fullest resistance of the water, to the position of each series in respect to the different parts of its passage through the water, causing each series to be less resisted by the water at its entrance into the water, at which part any power employed upon it produces a much diminished effect, and making it to be most resisted when it is at the lowest point of its passage, and consequently at that point at which it should be most effectively resisted, and, also, by causing the water to escape freely from between its opening spaces, in its passage from the lowest point of its path to the point at which it emerged from the water. But, though a wheel fitted in this manners fulfils in some degree one condition of a good propelling instrument, it falls lamentably short of attaining another. *It is a property of* water that its resisting power *does not depend* so much *upon the quantity of* surface forced against it as upon the form of the surface; and a board of twelve inches square will be considerably more resisted than two boards, each of which is twelve inches long and six inches wide; and again these two will be more resisted than three boards, each one being twelve inches long and four inches wide; and, yet, in these three cases, the quantity of surface is in measure precisely the same. As a consequence of this property, the division of a large paddle into a number of smaller ones is necessarily attended with a diminished resistance, and this effect is further increased by placing the paddles in the step-like manner in which they are placed in this wheel. From what has been said, it is evident, that the resistance of the water to the paddles of this wheel is at no one point equal to that resistance against the paddles of a common wheel; and, it will also be perceived, that this resistance is more variable than in that wheel; the resistance in the case of this wheel being least at the points, at which the beneficial return for power is least, and greatest, where this return is greatest. This variation in the resistance would, if the total amount of resistance were the same, be an extremely favorable feature in this wheel, but the diminution of the resistance, at every point of the wheel, prevents any advantage being derived from the variation of resistance; for not having the ability to consume power at the lower parts of this wheel to the same extent as in the common wheel, it is to little purpose, nay, it is injurious, that it should be saved at other parts of it; for, from the inability to consume it at the lower and better parts of the wheel, it would be better consumed at the upper and worse parts, where the return is less, than not be consumed at all, from the want of a sufficient surface to render the resistance of the water useful; nor is this objection removeable by any means, compatible with practice. But this wheel, which is much in use at present, possesses one good quality, in the greater smoothness of its action and consequent comparative freedom from vibration; and this quality may serve, especially in the case of passenger ships, to keep it in use much longer than it should be, from any other advantage it may possess.

Another mode of obviating the ad-

vantages of the common wheel consists in making the paddles move to and fro within a certain arc upon their centres. One method, in which this principle has been applied, is that of Mr. Morgan; wheels upon whose plan are, at the present moment, in extensive use in the government steam marine. This method was originally patented by Mr. Elijah Galloway, and, the patent having been assigned to Mr. Morgan, the plan was much improved by the latter gentleman, and by him introduced into use. The invention consists in a wheel, in which the paddles move upon their centres, making different angles with the radii of the wheel; their motion being effected by means of a centre, which is eccentric to the centre of the paddle-wheel; upon which eccentric centre there plays a collar, to which collar are affixed long rods, which, being connected with stems fixed at a large angle to the paddles, cause the latter to assume positions varying with the position of the paddles, in their passage through the water. By duly apportioning the length of the paddle stems to the distance between the centre of the paddle-wheel shaft and the centre of the eccentric centre, it is easy to make the paddles enter and leave the water edgewise and gradually expose such greater or less resisting surface to the water, as the varying position of a paddle in its passage may render desirable. If the parts of this wheel be properly proportioned, every paddle will enter the water edgewise, and at such a moment, not be at all resisted by it; and, as the paddle advances in its passage towards the lowest point of its path, it will continually expose more and more surface to the resistance of the water, until it reaches the lowest point, when it will expose its whole quantity of surface to the water; from this point again the quantity of exposed surface will continually diminish, until it emerges from the water, at which moment it will again present only its edge. Besides the advantages derivable from the varying quantity of surface exposed to the resistance of the water, a wheel of this kind possesses the property of rendering a more efficient return for any quantity of power imparted to it at any point, arising *from the inclination* of the paddles *from a radial towards* a vertical *position; which inclination,* as the line of resistance of the water is always in a direction perpendicularly against the resisted surface, necessarily places this line of resistance in a direction more nearly corresponding to that in which the vessel is required to move; and this greater correspondence between these directions, it has before been said, causes the power expended to produce a much greater return than if there were less correspondence between the directions. This may be rendered self-evident, by a resort to the process before mentioned; in applying which, we must draw a line perpendicularly against the surface of any particularly paddle, and assume that line to represent the amount and direction of the resistance of the water to the paddle; this line of resistance is the hypotenuse of a right angled triangle, of which the other two sides represent two forces into which this resistance is resolvable; one side representing the amount and direction of a force tending to raise or depress the vessel, according to the position of the paddle in its path, and the other side of the triangle, representing in amount and direction the force which is exerted is a horizontal direction, and that amount alone, of force which if effective in propelling the vessel. If we compare the length of this line, which represents the propelling force when the resistance is the same in amount against a paddle of this wheel as against one in a common wheel, we shall find it to be much greater in amount in the case of a paddle of this wheel than in the case of one in a common wheel. In fact, we shall always find that the greater angle the surface of a paddle makes with the line of direction in which the vessel moves, and, by consequence, the more the line of resistance corresponds with the line of direction of the vessel, the greater will be the comparative effect of any power, consumed by a paddle, towards propelling the vessel, and the less the waste of power expended in raising or depressing the vessel.

Thus, in a wheel of this kind, there are two advantages; one resulting from a diminished resistance at comparatively ineffective points of the passage of a paddle, and, another, arising from an increased proportional beneficial return for any quantity of power employed, upon a paddle, at any ineffective point. We have therefore all the advantages, as

gards the application of power, resulting from the division of the paddles of Field's wheel, and, also, the advantages of the good resistance of the common wheel, when a paddle is at the lowest point of a revolution, without the disadvantages of either of these wheels. But this wheel is not without its faults; for, when the framing of it is examined, it is found to be extremely defective in point of construction. In order to understand the nature of this objection, it will be necessary to premise that, in the common wheel, the main shaft passes through both the circular framings of the wheel; one part of the shaft resting upon the side of the hull of the vessel, and the other upon the beam, forming the outside support of the paddle-box. Now, in Morgan's wheel, the main shaft only passes through that framing of the wheel, which is next the vessel, and then terminates; and, by consequence, the outer framing can only be set in motion, by connecting it with the other framing by means of a complicated system of ties; rendering many rings for the framings necessary, and, after all, leaving the wheels strong only in consequence of the quantity of metal used in their construction; besides adding vastly to the expense of them by the unnecessary rings and ties. Another objection is, that the corrosive action of the sea-water, at all times great upon iron, is greater upon the working points of this wheel, in consequence of the continual exposure of fresh surfaces to the action of the water, by the rubbing off of the oxide formed, by the motion of the parts against each other. But, however objectionable the disadvantages of this wheel may be, they do not seem, from the increased employment of it in the government steam marine, to outweigh the many advantages resulting from it in other respects.

Within the last year, another wheel has been published by the author of this paper, having precisely the same objects in view as those proposed to be attained in Morgan's wheel; but, in which, those disadvantages of the latter wheel, which have just been described, *are obviated*. There appears, at first *sight, to be a great* similarity between *this and Morgan's* wheel; and this *mainly arises from the* inventor of this *wheel having adopted* the polygonal framing of Morgan's wheel, and from the positions of the paddles being the same in both wheels, and also from the employment, in both wheels, of a crank, within the wheel, as a turning point for the guiding apparatus; but, as the polygonal framing, though elegant, and perhaps useful, is of no importance to this, or Holebrook's wheel, and, as the positions of the paddles form no part of Mr. Morgan's invention, and, further, as the employment of the crank, for the purpose just mentioned, was published before Mr. Morgan's patent was obtained, and, therefore, not an application to be confined to Mr. Morgan's wheel alone, and is, besides, not actually necessary to this wheel, any resemblance between the two wheels, in the respects just described, may be dismissed without further observation: in any other respect, the two wheels will be found, upon a careful examination of their construction, to be as opposite as any two things can be. With regard to the manner in which the positions of the paddles are attained, in Holebrook's wheel, it may be observed, that, in this, the guide wheel, or that wheel which is employed to guide the paddles, is essentially, and from the nature of the method, of a large size, as compared with the collar, used for the same purpose in Morgan's wheel; and the guide and paddle wheels, in Holebrook's plan, are linked together, according to a method, long, long since published; which mode of linking, also essentially necessary and indispensable to this plan, obliges every linked point of the guide-wheel to perform one revolution round an equivalent point of the paddle-wheel, in every revolution of the combination; and this revolution of these and other parts renders the novel and peculiar points, at which the guide rods of the paddles are attached to the guide wheel, capable of producing the positions of the paddles, which are obtained in this wheel. If these linked points of the guide and paddle-wheels, did not perform this revolution, but remained as they would, with a large guide wheel on Morgan's plan, always in advance of the paddles, no such positions of the paddles, as are obtained in this wheel, could be produced, unless the whole wheel was made to resemble exactly Morgan's combination. The parts of this wheel are as essentially and necessarily

different, in direction, position, and measure, from the same parts in Morgan's wheel, as they can be: for, if both wheels be narrowly examined, it will be seen, that, in Holebrook's wheel, the position of the centre, upon which the guiding apparatus turns, is, as regards the centre of the paddle wheel shaft, vertically above, while, in Morgan's wheel, this part is nearly horizontally to the right; the guide wheel, in Holebrook's wheel, is necessarily large, while, in Morgan's, it is conveniently small; in Holebrook's wheel, the point of attachment, of the guide rod of the lowermost paddle to the guide wheel, is nearly horizontally to the left of the point of attachment, of this guide rod to the paddle itself, whereas, in Morgan's wheel, this point is, as regards a similar point, vertically above; the guide rods, in Holebrook's wheel, are short, and nearly sinal in direction, while, in Morgan's, these parts are long and nearly radial in direction; and, finally, the paddles, in Holebrook's wheel, have no stems, but such as are necessary for strength, and these stems are in a direction parallel with the surfaces of the paddles, while, in Morgan's wheel, the paddles require to have other stems, in addition to strengthening stems, projecting, besides, at nearly a right angle from the surfaces of the paddles. Thus, it will be perceived, that, if the formerly noticed immaterial points of resemblance between the two wheels be discarded from view, the parts of each wheel are as greatly dissimilar, as they can possibly be.

The greatest advantage of this wheel over Morgan's is in the construction of its framing. It has before been stated, that, in Morgan's wheel, the main shaft terminates directly it has passed through the inner framing of the wheel; but, in Holebrook's wheel, this faulty construction does not obtain, because the main shaft is continued to nearly the outer framing of the wheel; and it is connected with this framing by a frame of a peculiar form, the centre of which is affixed to the extremity of the shaft, and the ends of the arms of which are attached to the outer framing. By this peculiar frame, power is directly transmitted from the shaft to the outer framing of the wheel; thereby rendering the complicated ties, extra rings, and heaviness of construction of Morgan's wheel, entirely unnecessary. In addition, it is proposed to obviate, if not entirely, at least to a very great extent, by a particular plan, the corrosive action of the sea water upon the working points of this wheel. By this it will be perceived that this wheel has all the advantages resulting from the proper employment of power which takes place in Morgan's wheel, together with greater strength of construction, greater simplicity, and greater lightness, and, also, a greatly, if not an entirely, diminished destructive action of the sea water.

Among other alterations of the common paddle-wheel, it has been proposed to divide the large paddles of it in the direction of a plane, parallel with the framings of the wheel; the wheel being, by this method, separated, as it were, into three or more narrower wheels or parts, and then one wheel or part being advanced through two-thirds of the arc, contained between two large paddles of the undivided wheel, and another wheel or part being advanced through only one-third of the same arc, leaving the other wheel or part in the position it might be supposed to occupy before the division took place. In such a wheel as this, with which the *British Queen* has been fitted, the paddles being, of course, placed radially as in the common wheel no greater beneficial result from any given quantity of power imparted to it, provided the resistance of the water be the same, can be derived from it, than from the common wheel; but, from the division of the paddles, there results a greater equability of action and comparative freedom from that tremulous motion which is so disagreeable in steam-vessels; and there also results a less resistance from the water in every part of the passage of a paddle through the water, which less resistance tells in favor of this wheel when a paddle is entering and leaving the water, and against it when it is at the bottom of the wheel; because, it has before been shown, that it is desirable to consume least power at the points of entrance and emersion, and the greatest power when a paddle is at the lowest point of its passage. For passenger ships, in which easiness of action is of more consequence than the amount of effect obtained from the application of a certain power, this wheel may hold out against the common wheel;

with which no other advantage it possesses will enable it to contend.

Intimately connected with the common wheel, another modification has been also produced by the author of this paper, entirely different from any of the preceding plans. Before this one is described, it may perhaps be desirable to make a few introductory remarks, which may serve to show those disadvantageous properties of the common wheel, which this modification is intended specially to remove. A steam-engine is considered to produce its best effect when it makes a particular number of strokes per minute. Now, the number of strokes which an engine makes, is, in a great degree, dependant upon the resistance of the water to the paddles; and this resistance depends upon the length of the path of the paddles, or, in other words, upon the degree of immersion of the wheels; and the immersion of the wheels depends upon the immersion of the vessel itself, which again is greater or less, according to the quantity of coals within the vessel. Under common circumstances, therefore, as the coals are consumed, a vessel is rendered lighter, the wheels are less immersed, and, finally, the resistance to the action of the engine is less. If a vessel, when it starts from a port, has its wheels so immersed that the resistance to the engine is exactly what it should be, it is quite clear that as the coals are consumed, and the vessel rendered lighter, the resistance will be too little, and the engine will make more than its proper number of strokes, and make these less effectively. On the other hand, if a vessel leaves a port with its wheels too much immersed, then the engine will work too slowly, and consequently with less effect than it should, in this case the evil will day by day decrease until the proper degree of immersion is obtained. In another case a vessel may leave a port with its wheels so much immersed as to have them only properly immersed, when midway on its voyage, and consequently before and afterwards, too much or too little immersed. In all these cases it is clear that there is but one point of a voyage in which the power of an engine can be most profitably exerted, while, in all other parts the engine will not produce its proper effect, by being too much or *too little resisted.*

A moment's consideration must show that a small degree of immersion of a vessel is in itself a benefit, and one of which advantage, if possible, ought to be taken. It is also apparent that the wheels of a vessel could not be made to move upward and downward without alterations and machinery, to the making or application of which there are many insurmountable objections. The only way then which there appears to exist of accomplishing the equal immersion of the wheel, is to cause the paddles of as large a wheel as can at any time be desirable, to move along the arms of it, either from or towards the centre of it, as the degree of immersion of the vessel may render proper, by which a paddle-wheel may be readily converted, as regards effect, into a large or small one.

It is clear that in a wheel of this kind, as the paddles are placed radially, as in a common wheel, and also as no diminution of quantity of surface takes place, at any point of the passage of a paddle through the water, the effect from the expenditure of power upon this wheel will be exactly the same as from the same expenditure of power upon the paddles of a common wheel, the object of this wheel being only to render the engine at all times equally effective. The paddles in this wheel are provided with bolts, which are not firmly fixed to, but are capable of sliding upon, the arms of it. To the paddles bars are fastened, having those ends of them which are out of the water screwed; and these ends are inserted into nuts, the outsides of which are furnished with teeth. Into the teeth of these nuts there works a large and long wheel in the form of a reel, moving upon that part of the main shaft which is within the framings of the paddle-wheel; the parts of this reel which play into the teeth of the nuts, being furnished with teeth; and finally, fixed to that framing of the paddle-wheel nearest the vessel, there is a small wheel provided with teeth, which plays into the teeth of the reel; one end of this small wheel being squared and tapered in order to fit a key, by the turning of which the paddles all at the same moment are made to depart from, or approach towards, the centre of the wheel. With a wheel thus fitted up it is evident that if a vessel started from her port with the paddles properly immersed, and

on the next day had them, by the consumption of the coals, too little immersed, it would only be necessary towards righting them to apply the key to the apparatus of the wheel, and in a minute the paddles would have their proper degree of immersion. It cannot be denied that the apparatus of this wheel is effective for the purpose proposed, and that the wheel is as strong as the common wheel, and besides that the wear upon the working points is almost nothing, these being only in motion about a minute in a day, and at all other times, being as rigidly fixed, as the parts of a common wheel. But an increased expense of construction is chargeable upon this wheel, and it is also liable to the destructive action of the sea water upon those parts of the arms of the wheel upon which the bolts slide, and also to the same action upon parts of the bolts themselves; this destructive action, however, cannot be much, because there is no continual rubbing motion, and therefore the very oxide formed upon the iron will in some measure protect the exposed parts from further action. In order to obviate entirely, or in a great degree, the destructive action of the sea water upon parts of this wheel, it is proposed to apply the plan to which allusion has before been made; therefore it only remains to be determined whether the increased expense of construction of this wheel will be considered more than sufficient to compensate the advantages derivable from it; and this is a question which experience will best decide. Besides the advantage arising from this wheel already mentioned, resulting from the ability to more and more immerse the paddles day by day, there are others, but into a detail of these it is unnecessary now to enter.

In addition to those already described, there are numerous other modifications of the common paddle-wheel, some of them displaying a great portion of knowledge and inventive skill; but as these are either ineffective or attended with countervailing disadvantages, a description of them and their properties would here be out of place. It is therefore now proposed to enter upon a consideration of the properties of the screw, with reference to its applicability to purposes of propulsion; and also to give a description of two modifications of this contrivance which are actually under trial.

In applying the screw to the propelling of vessels it is absolutely necessary to bear in mind that the nature of this mechanical contrivance is such, that while it maks one revolution, every part of its thread is replaced in a line, parallel with its axis, by some other part of the thread, at a distance backward or forward, precisely the same in measure as the distance between any two coils of its thread is when measured on the same line. It will therefore be absolutely necessary, in order to prevent the screw from retarding the progress of a vessel in motion, that the thread of it should, in common parlance, pass backward during one revolution of the screw, as much as the vessel during the same revolution passes forward. But with the thread of the screw in such a direction it could not propel a vessel, but would only not retard its progress. It should be borne in mind that such a propeller being applied to so yielding a medium as water, it might be made to revolve faster, and the thread to pass more backward than has been just supposed, without the resistance of the water to its revolution, being sufficient to overcome the friction of the water against the vessel; and consequently without this extra speed of revolution producing any effect in propelling the vessel. It will therefore be absolutely necessary that the thread should pass backward through a space a trifle greater than is equivalent to the progress made by the vessel, and to the ineffective progress of the screw from the want of sufficient resistance from the water. When the thread of the screw is thus placed upon a shaft, and supposing that at its circumference the angle of the thread with the direction of the axis is 45°, it will be found that as the thread is nearer to the shaft, the angle it makes with the direction of the axis is less; until, if we conceive the thread to be concluded in precisely the centre of the shaft, the thread itself far from being a helix, will, in fact, become the axis of the screw. Now, it must be self-evident to every one, that the motion of a body in a circular direction sideways, whose surface is not at all inclined from the direction in which motion is required to be given,

cannot produce motion in such a direction; and this is, besides, demonstrable by the process in mechanical science before mentioned, because the line representing the direction of the resistance of the water, being in a direction perpendicularly against the surface of a moving body, and this surface being in the case under consideration, in the direction of the axis, the line representing the resistance of the water cannot be the hypotenuse of any right angled triangle, one of whose sides will be in the direction of the motion of the vessel; consequently the whole resistance of the water will be expended in retarding the motion of the revolving body, and therefore utterly wasted as regards any propulsion of the vessel. If the action of the water be examined, at the circumference of the screw, where the angle with the axis is 45°, it will be found that the line representing the resistance of the water, this line being in direction perpendicularly against the moving surface, will be the hypotenuse of a right angled triangle, one of whose sides will coincide with the direction in which the vessel is required to be propelled; and, as a consequence, the resistance of the water will be resolvable into one force, tending to press the vessel laterally, and therefore ineffective for propelling purposes, and also into another force in the direction of the motion of the vessel, and therefore one capable of propelling the vessel. By pursuing this process, with respect to the propelling resistance of the water against other parts of the screw, situated between the circumference and the shaft, it will be found, that the nearer any part is to the shaft, the less will be its propelling power, and *vice versa*. But not only does the propelling power diminish as the shaft is approached, but, unfortunately, the resistance of the water is increased by the greater angle that any part of the surface, nearer the shaft, makes with the plane, in which the screw revolves. This greater resistance may be familiarly illustrated, by supposing the case of two ships, one having the fore part of its hull perfectly flat, and the other having the same part built in an inclined manner, upon the most *approved principles: in two* such ships, *the section of resistance* of each of the *quantity of water displaced* by the forward motion of each is precisely the same; but experiment shows that the resistance is extremely different. On the other hand, it is quite true that the smaller circle through which the parts revolve, which are nearer the shaft, causes a proportionate decrease in the consumption of power, as this circle is lessened; nevertheless, the resistance of the water increases much faster than the circle, in which it is exerted, is lessened; for, suppose a part, midway between the circumference of the thread and the axis, is taken for examination as to the amount of this resistance; it is quite clear if the thread made the same angle with the axis, at such a part as it did at the circumference, that the resistance of the water would be only one half what it was at the circumference; but, as the angle which the thread or resisted surface makes at the midway part with the line of revolution of the screw, is greater than at the circumference, and as the amount of this angle regulates in some measure the amount of resistance, it is, therefore, evident that the resistance is greater than one half, which is the amount that it should be, if the resistance diminished as the circle diminished. But this increased comparative resistance of the water is also aggravated by the effective result, for purposes of propulsion, being also lessened in consequence of the nearer approach, in direction of the thread of this midway part to the direction of the axis, as has before been shown. Thus, it will be seen, that, as the thread approaches the axis, the greater is the comparative resistance of the water, and the less the beneficial result from any given amount of resistance; in other words, that, while the consumption of power is comparatively increasing, the beneficial effect is constantly decreasing, a result which, therefore, shows the propriety of consuming power, as much as possible, at those parts of the thread, which are farthest from the axis.

But the employment of power near the circumference, though less objectionable is not without its disadvantages; for, in consequence of the line of resistance not corresponding in direction with that of the desired motion of the vessel, a large part of the power is wasted, intending to give lateral motion to the vessel. It is true that this line of resistance may be

made more to approach the line of the motion of the vessel by increasing the diameter of the screw; because as the circumference of a screw is greater, there being no increase in the number of coils, the more nearly will the direction of the thread approach to a line, at a right angle to the axis; and, consequently, the line of resistance against any part of such an enlarged circumference, will more nearly approach to a line in the direction of the motion of the vessel. But the limits, within which a screw propeller must be constructed in regard to diameter, are necessarily small, and, consequently, if a good direction for the line of resistance is desired, it appears to be only practically attainable by lessening the inclinations of the thread, and giving this such a direction as that, at the circumference of the screw, it shall nearly approach the direction of a line making a right angle with the axis. Now here, again, objections meet us; for it is quite clear, that if the inclination of the thread be lessened, the velocity with which the screw revolves must be increased, and, besides, as the inclination of the screw is lessened, the resisting power of the water will be continually diminished; until when the inclination is very small, it will be reduced to almost nothing. If to make up for the want of resistance, we increase the velocity so as to make the water resist similarly to a solid, we shall scarcely obtain any comparative propelling power, because an extremely large amount of force will necessarily be lost in counteracting the friction, arising from the more perfect and solid-like resistance of the water; for it must be evident that, if the water by any excessive velocity being given to the screw, be made to give a resistance similar to that of a solid, the screw, which presses against it, will be subject to a friction of a similar kind to that which it would experience in pressing against a solid, and as with the increasing velocity, the space through which the friction would operate would be increased, therefore, as the velocity increased, so would also the friction increase.

Thus, in the application of the screw to propelling purposes, we find ourselves in a dilemma, from which escape is impossible. For, if the thread be so placed that its line of inclination very nearly approaches the direction of the axis, we obtain a great resistance, of which an extremely large part is employed in tending to give lateral motion to the vessel, while only a very small portion is effective for propelling the vessel forward. If we use the screw at an angle of about 45°, or midway between extremes, we find diminished resistance, but a considerably greater quantity of force employed in propelling the vessel forward, while also a much less amount is employed in tending to press the vessel laterally; yet the amount of wasted force is very great, even in this case. And, finally, if we make the thread to pass across the axis at nearly a right angle to its direction, then it becomes necessary to increase the velocity greatly; which, when proper resistance is produced, we find to have caused a vast expenditure of force in overcoming friction, while only a very small amount of the power consumed, will be effectively employed in giving forward motion to the vessel.

One application of the principal of the screw has been made by Capt. Ericsson, which is at present under trial, and of which some idea may be obtained from the following description. From the stern of the vessel and under the water-line, there protrude two short parts of two shafts, one part longer than the other, and one being tubular and the other solid; by which construction one part is enabled to revolve within the other. To each of these shafts, is affixed, by means of bars in form like parts of the threads of a screw, a hoop, upon the outside of which are arranged leaves, in shape forming parts of threads of a many-threaded screw; the inclination of the threads of which is such as would be produced, if each thread, in coiling once round a cylinder, of the same size as the hoops, passed in the direction of the axis of the cylinder, through a space equal to three times the diameter of it. Each hoop is made to revolve in reverse directions, and the sternmost one rather faster than the other; the leaves, consequently, upon each hoop are oppositely inclined. The space, which is taken up by the exterior part of the apparatus, is very small, and its form is such, as scarcely to render necessary any external alteration in the fitting of it to a sailing vessel.

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other with which a comparison is proposed to be made. By pursuing this method, and paying strict attention to all the conditions of the experiments, results would be obtained which would soon, and with less cost than now takes place, settle the order in which different propellers should be placed, in respect to their effective powers.

J. P. HOLEBROOK.

8th August, 1839.

BALLOONING.

Sir,—If you think the following observations worthy of a place in your valuable Magazine, I beg you will insert them, and by so doing you will oblige,

Your humble servant,

TANGAR.

Manchester, August 8, 1839.

To Mr. W. H. Weekes,

Sir,—I take the liberty of addressing a few lines to you on the subject of aerostation; upon which you have so ably treated in the *Mechanics' Magazine* of Saturday last.

I think your chief objections to the present mode of ascension and descension by balloons, are the present methods of attaching the car to the balloon; the form of the car; the means of ascending by throwing out ballast; and descending by allowing an escape of gas.

Now your improvements consist in attaching the car to the balloon, by an inflexible pipe; in forming the lower part of the car so as to contain a quantity of condensed gas; and your method of descension, by drawing a portion of gas out of the balloon, and forcing it into the lower part of the car or reservoir.

And, as I conceive your intended improvements would be complete failures, I will state to you my reasons for so doing.

As I have not taken the trouble to ascertain the contents of your balloon, or the ascending power of pure hydrogen, I will suppose that your calculations are correct, and I shall make mine accordingly.

I propose that the reservoir for a balloon 40 feet diameter, should be 9 feet long, 6 feet wide, and 2 feet deep, inside measure; to be made of $\frac{1}{8}$ inch sheet copper, that it be attached to the balloon by a pipe 60 feet long, and 2 inches diameter, made also of $\frac{1}{8}$ inch sheet copper; you, perhaps, may think that it is not necessary to have a reservoir so large, but it will be found to be rather too small than otherwise; this reservoir will weigh at least 840 lbs.; the pipe will weigh 156 lbs.; the condenser, woodwork of the car, and other apparatus, at least, 100 lbs.; and the balloon and parachute, 60 lbs. more; so that the gross weight would be 1156 lbs.; you estimate your ascending power at 1469 lbs., which will leave 313 lbs. for the weight of the aeronauts.

I will now suppose that you are ready to ascend, the word is given, the balloon is liberated, and up you ought to go, but there is a weight of 1409 lbs. attached to the balloon, by a pipe 2 inches diameter, or a circumference of 6.28 inches. Now what kind of a material would you make a balloon of, that a surface of little more than 6$\frac{1}{4}$ inches at the top, and the same at the bottom of the balloon, would support a pressure of 1409 lbs.? You would find instead of going up, you would have to stay down, and your balloon would tear from the pipe to which it had been attached.

This is my first reason why your improvements would be failures.

But we will even suppose that the material of which the balloon is composed, was strong enough to support it; and that you rise from the earth to the altitude of 9000 feet, where the air is only two-thirds of the density that it is on the surface of the earth—now, to prevent your balloon from bursting, you will have to exhaust 11,170 feet of gas from it, before you attain that altitude. This gas you would condense into your reservoir; well, let us see what room there is for it there.

This reservoir will contain 108 cubic feet, and, if we suppose that there is a perfect vacuum in it; if you open the valve placed between the balloon and reservoir, 108 feet of gas will rush into it out of the balloon; still you will have 11,062 feet too much in the balloon; you then shut the valve, and work the condenser, which I propose to be 3 inches bore, and 6 inches stroke, and will, therefore, contain 42 cubic in.; now 11,062 ft., contain 19,115,136 inches, which divided by 42, will give 455,122 strokes of the condenser, to force 11,062 feet into the reservoir; and this you must do merely

to prevent the balloon from bursting, laying aside the question of attempting to descend. But you would find it impossible to work the condenser the requisite number of strokes in the same time that the balloon would rise to that altitude, even if you were possessed of the power requisite to condense air into $\frac{1}{10}$rd of its natural volume; this is my second objection to your scheme of ballooning.

But I am tresspassing too much on your time and patience, and, if you find that I am mistaken in my views and calculations, I shall feel highly obliged if you will point them out at your earliest convenience, and very likely I may afterwards point out one or two other objections to your plans.

I remain,
Yours respectfully,
TANGAR.

A SUBMARINE REGISTER, OR AN IMPROVED SOUNDING INSTRUMENT FOR ASCERTAINING THE DEPTH OF WATER BY THE COMPRESSION OF A COLUMN OF AIR IN A GLASS CYLINDER.

Sir,—I beg respectfully to submit the enclosed to your consideration.

Your obedient servant,
WM. JONES.

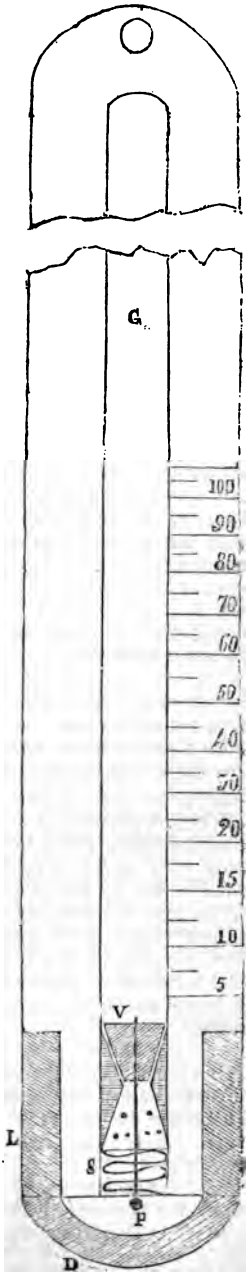
Remarks.—I wish it to be distinctly understood, that I do not lay any claim to originality with respect to the principle, but to the peculiar construction of the instrument, its great simplicity, and the rapidity, ease and correctness with which observations can at all times be made, either by day or night; in the densest fog; and at the usual rate of sailing.

It is particularly worthy of notice, that the result of the experiment can be kept a considerable length of time, for a careful examination.

The whole is let in flush with the wood case, and is provided at the top with a ring or aperture for tying on the cord.

The only practical objection, that can be raised is a possibility of choking, but that can be met by making the holes for admitting the water very small.

Explanation.—A smooth glass cylinder, G, open at one end, has to that end a conical metal valve opening inwards, V, and kept in its seat by a weak spring S.



strument—the sliding rule—in the form given by Bevan.

A	Weight in tons.
B	Pressure in inches.
C	547.
D	Diameter in feet.

IMPROVED METHOD OF CASE-HARDENING IRON.

Sir,—Among the other good qualities which render iron so valuable to the artisan, is the peculiar and important property which this metal possesses of being readily converted, either wholly or in part, into *steel*. The entire conversion of masses of iron into steel by cementation, is a process perfectly well understood and very fully explained in most works treating upon the subject of metals; but the partial conversion of the surface of various articles of iron, after being manufactured, is a process of even greater convenience if not of greater value, and one upon which I beg to offer a few remarks. In this manner various tools and instruments of common use, such as fire-irons, keys, bridle-bits, stirrups, &c. &c., are formed with great facility in soft iron, and by the subsequent conversion of their external surfaces into steel, by the process of *case-hardening*, they combine a toughness and a hardness not otherwise attainable. If formed wholly of hardened steel, brittleness would be their common defect; while made of iron in its unaltered state the instruments would be altogether too soft for the purpose for which they were intended.

Innumerable articles are therefore continually manufactured from soft iron, which are subsequently coated with steel by an incipient kind of cementation. The method usually adopted has been to place the articles to be hardened, in an iron box filled with vegetable, or what is better, with animal charcoal; this box, with its contents, being exposed to the action of a strong fire for an hour or two, a partial conversion of the surface of the iron takes place, its depth being proportioned to the duration of the process, the size of the articles, &c. But the time is always incomparably shorter than would be necessary for the entire conversion of the whole mass of the metal. After remaining in the fire the proper time the box is taken out and its contents suddenly thrown into cold water, which effectually hardens the steel coat which has been produced. The articles thus treated are susceptible of a high degree of polish, which forms the finishing process.

This mode of case-hardening has the disadvantage of being inconvenient and tedious, and it has been recently improved by the employment of prussiate of potash (Ferrocyanodide of Potassium.)

Although this valuable discovery is of very recent date, I am unacquainted with its author; the fact is noticed as "*an improvement of great value*" in "Gill's Machinery Improved," and also in "Ure's Dictionary of Arts and Manufactures," both published at the beginning of the present year.

Notwithstanding these publications, this discovery is but little known, and a workman, within my own knowledge, a very short time since, purchased the "art and mystery" of case-hardening with prussiate of potash, as a "*valuable secret.*"

I trust, therefore, in calling the attention of your readers to the subject, I shall be diffusing a more extended knowledge of what I know experimentally to be a highly useful and convenient process.

For this purpose let the crystals of prussiate of potash be reduced to a coarse powder: having your iron articles well cleaned off, heat them at the forge to a bright red, take them out and strew some of the prussiate of potash over them, which will immediately fuse and spread upon the surface, return the article to the fire, and restore the heat, when sudden quenching in cold water will give the required hardness.

By this means, *case-hardening* is more effectually completed in *two minutes* than it could be in *two hours* by the old method, besides which, the workman has the power of case-hardening *part* of any iron instrument, while the remaining portion continues in its original state. This process is also applicable to many articles which could not be conveniently subjected to cementation, and may be applied to cast as well as wrought iron goods.

I remain, Sir, yours, respectfully,

WM. BADDELEY.

London, August 7, 1839.

IMPROVEMENT UPON MESSRS. BUNNETT AND CORPE'S CONCENTRIC STEAM-ENGINE AND ALLEGED COLOURABLE IMITATION OF THE SAME BY ANOTHER FIRM.

Fig. 2.

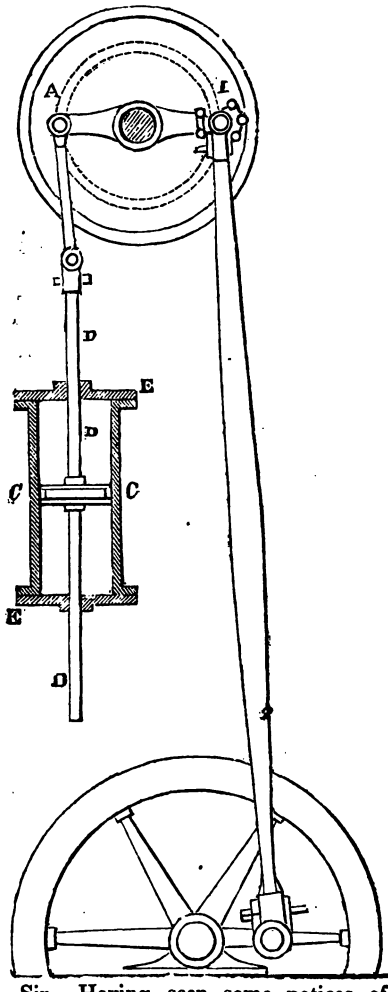
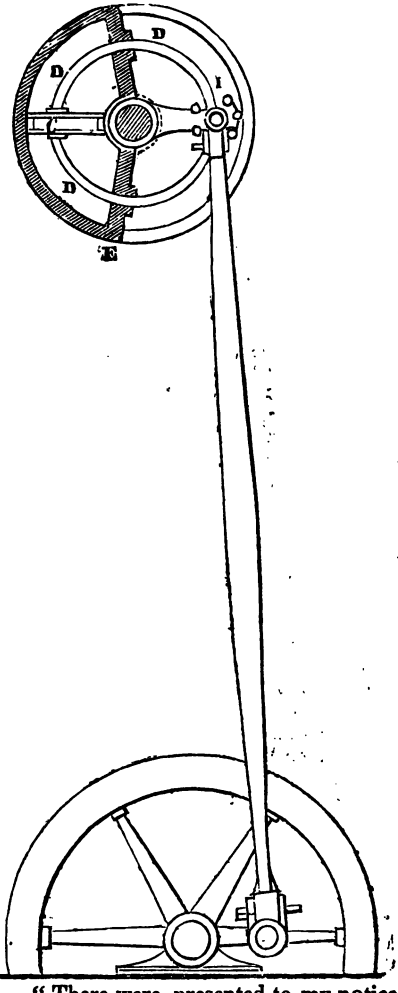


Fig. 1.



Sir,—Having seen some notices of Messrs. Bunnett and Corpe's new engine in your valuable work, I beg to forward you a translation of part of a letter from a foreigner (Mynheer Van Hoom-Boogd,) upon the subject; and if you think it worth the perusal of your readers, its insertion will oblige,

Sir, yours most obediently,

W. P.

32, Windsor Terrace, City Road,
July, 1839.

"There were presented to my notice some time ago some strong recommendations of a patent steam-engine upon new principles, made by Messrs. Bunnett and Corpe of your city, accompanied with details of experiments tried by them to prove its advantages—and having a desire to use steam power in lieu of my horse machine, I was induced to order one of these engines, and to have it erected in my manufactory. I should observe, that not having see

ficient floor room in the place where I wished it to be fixed—I had it placed above the shaft destined to receive motion for it, as shown in Fig. 1.

"Well, it worked tolerably for a month or two, but after that, I soon began to find that it was continually leaking and getting out of order. We repaired it again and again, until we found the expenses of these repairs so enormous, and the constant stoppage attendant upon them so inconvenient and the engine becoming worse and worse every day, instead of better, that I had serious thoughts of removing it altogether, and of resuming my old horse power—but my English engine man (Tom Comonsens, by name) asserted, and showed me by taking the engine to pieces—that one great cause of the trouble was the unequal wear it was subject to—saying at the same time that he could remedy this evil by merely straightening the piston rod D, and making the piston C move in a straight box instead of a curved one, as shown in fig. 2, connecting the end of the rod to the arm I, by means of a small link and bar A. I permitted him to make this trifling alteration, on condition that he should not at all alter the position of the arm I (to some remarkable property of which I had been told a great part of the advantage gained by this engine was to be ascribed) and it was accordingly done. Since then the engine has worked very much better, and we have had no stoppings or delays to repair it on account of unequal wear. Comonsens asserts, that it might have been made for about half the money, had it been originally constructed in this way.

"I am, &c.

"VAN HOOM-BOOGD, A.S.S., &c."

"P. S.—Since writing the above, I have been to see an engine which a manufacturer in this neighbourhood has just purchased—and which is said to throw mine quite into the shade. To my great astonishment I found it in principle precisely similar to my own—the only differences worth notice being that the piston C and rod D, with the box in which they moved, were round instead of square—and the distance between A and I was something more than in mine. The proprietor says it was made in England by some people of the name of *Boulton and Watt, but it is* such a flagrant plagiarism, that I cannot help thinking, that the manufacturers, whoever they are, must either have peeped through my window or bribed my servants. At any rate, I think it but right to call the attention of the patentees to the fact.

"It is said, that this new engine does 30 per cent. more work with the same expenditure of fuel than mine—that it costs only half the money—and that it only requires half the repairs that mine does—*and this even with my improvements upon it.* I cannot reconcile this statement with the expectations I had formed of the vast superiority of this engine over every other variety which could possibly be made—but I shall, no doubt, soon ascertain whether or not the assertion be true.

"I intend to be at your great scientific meeting about to be held at Birmingham. I hear that some experiments have lately been tried there upon a grand scale—with some immense fires—and that great bodies of the inhabitants of the town, including some of the authorities have been interested in the subject. Their exact object, however, I have not been able to learn. No doubt it was one worthy of the well known intelligence of that great manufacturing population."

RECENT AMERICAN PATENTS.

(Selected from the *Journal of the Franklin Institute.*)

WORKING STEAM EXPANSIVELY, *Isaac V. Adams, Boston.*—The nature and object of this invention are thus described by the Patentee:—

"My said invention consists of an addition to each end of the common slide valve in such manner as to form apertures through which the steam must pass in entering the cylinder; these apertures agree in dimensions with the induction apertures in the valve seat, (this valve I shall call the slide valve) and furnishing the outer surface of the slide valve with a sliding plate, or plain slide valve, which I shall call the cut off valve; the two valves are operated by two eccentrics, the one which operates the cut off valve being placed on the shaft with its most eccentric part in advance in the direction of its motion of the most eccentric point of the eccentric which operates on the slide valve, so that the cut off valve is always brought to either extreme of its motion before the slide valve, and consequently returns in season to cover the aper-

ture through the opposite end of the slide valve, and thus to cut off the communication between the steam chest and the interior of the cylinder at a half stroke, more or less, this circumstance being governed by the relative position of the two eccentrics in their orbit of rotation.

"The communication between the steam chest and the interior of the cylinder being thus cut off, the steam already in the cylinder will exert its expansive force upon the piston until it has reached one extreme of its motion, when the steam is allowed to escape from the cylinder as usual; and so on alternately.

"I claim the combination with steam engines of the slide valve having apertures constructed and operating as above described; and also the combination of the cut off valve with the slide valve, as above described and set forth. The purpose of the apparatus claimed being the working of steam expansively and in a more complete and advantageous way than has been heretofore practised. I also claim the mode above described of giving the proper motion to the valves, viz., placing the cut off eccentric in advance of the slide valve eccentric, as above described."

Lead Smelting Furnace, *Drummond and Fuller, Galena.*—The smelters furnace which is the subject of this patent, differs but little, except in the proportioning of its parts, from the furnace ordinarily used in England for the same purpose; but the Patentees aver that by the changes which they have made, there is a substantial difference in the effect produced; and although a mere change of proportions is not a patentable improvement, yet when a new result is obtained by it, such a change becomes a legitimate subject for a patent. There is, however, as will appear by the claim, a provision for constructing the hearth, so as to keep it at a comparatively low temperature, for the purpose of cooling the unsmelted part of the ore, and to prevent its running down with the lead; the latter remaining in a fluid form at a temperature lower than that which will solidify the fused ore, and, consequently, detain it on the hearth.

Claim.—"What we claim as our invention, and wish to secure by letters patent, is not the mere reduction in the general dimensions of the furnace, when compared with what is known as the English furnace, but to such a mode of constructing and proportioning the respective parts, as above described, as promotes the separation of the lead from the mineralizers with greater facility and economy than have been hitherto attained; a result which is principally dependant upon the acceleration of the current of heated air in contact with the ore in the furnace. We also claim the manner of constructing the hearth of the furnace, as above described, by which we are unable to keep it at a comparatively low temperature, which not only renders it very durable, but prevents the formation of slag, and causes also the grain, or unseparated particles of ore, to become chilled, preventing the running down thereof, whilst the reduced lead being in a perfectly fluid state, escapes readily; a result not obtained in the English furnace."

Packing and Storing Ice, *Frederick Tudor, Boston.*—"The nature of my invention," says Mr. Tudor, "consists in packing or storing, in the following manner, by means of any non-conducting material which will fill the interstices of the blocks of ice, as is hereinafter mentioned, and exclude the atmosphere—to wit., the floor, or bottom of the place where ice is to be stored, having been properly prepared, and the ice having been cut into blocks of convenient size, one layer of blocks is placed upon said floor, or bottom, and the interstices between said blocks are to be carefully filled with any nonconducting material, and a layer of said nonconducting material spread over the whole; a second layer of blocks is then to be put on the former layer, and all the interstices filled as before, and a layer of said nonconducting materials spread over the second layer, and so on until the required quantity is stored.

"Various nonconducting materials may be employed for the purpose, such as sawdust, pulverized cork, rice chaff, or any other which may be preferred, and which may be adapted to the filling of the interstices between the separate blocks and the layers of ice. The bottom and sides of the receptacle may be prepared in any of the ordinary modes of so doing; my improvement consisting entirely in the filling of the spaces usually left between the separate blocks of ice, with any suitable nonconductor, it having been found that by so doing, the ice is preserved from melting for a much longer period than usual.

"What I claim as my invention, and wish to secure by letters patent, is the application of any nonconducting material as aforesaid, in the manner above stated, to the packing or storing of ice, thereby destroying or relieving the altitudinal pressure of vapours generated by the ice, and preventing the wasting, melting, and decaying of the same."

It will be admitted by all those who are acquainted with the career of the Patentee, that he must be one of the best practical judges in the world of the most advantageous

modes of stowing and transporting ice, as he has been the great transporter of ice bergs to the torrid regions. It cannot be doubted that by excluding the air, or preventing the interchange of its particles among the blocks of ice, it will be more effectually preserved than without such precaution; but had the theory of its action been omitted in the specification, it would have been equally valid, and we should have been spared the attempt to guess what are the vapours generated by ice, whose *altitudinal pressure* affects it with consumption."

Culinary Refrigerator, *Henry V. Hill, Washington.*—The object of this improvement in refrigerators, employed for the preservation of articles of food, is to dispense with the metallic lining generally used, whilst the timber is rendered more durable, and the instrument more effectually preserved from any offensive odour. The following is the Patentee's description:—

"I construct a double box, or chest, in the usual way, interposing between the two pulverized charcoal, or any other bad conductor of heat, as has heretofore been done; but instead of lining the inner box, or chest, with zinc, or other metal, I saturate the wood with a resinous composition, which I cause the pores of the wood to imbibe by means of heat; the composition which I generally use, and the means by which I apply it, are as follows:—

"I combine together about two parts of rosin, and one part of beeswax, and by means of iron made as hot as can be admitted without actually burning the materials, I spread this resinous matter over the inside of the box, continuing the operation until I have forced as much of it into the pores of the wood as they will imbibe, and also leaving a thin coating thereof upon the surface. This preparation will effectually protect the wood from the action of water, and consequently from decay. I sometimes, especially when the refrigerator is to be kept in a damp place, coat the outside thereof with a similar resinous material, in the same way. The composition may also, if preferred, be applied to the exterior and interior of the boxes, or cases, constituting the refrigerator."

Mowing Machine, *Ira Wheeler, Salem.*—The main feature of this machine consists of a cart (without a body) drawn forward by animal power, and to which, on one side, is suspended a frame containing a horizontal vertical wheel fixed on a revolving vertical axle, around which, at the bottom, are a number of horizontal scythes for cutting the hay, &c., which, as fast as it is cut, "is carried round by fingers and deposited on a revolving endless apron in the rear of the same, which conveys it off at the end of the frame, and lays it in winrows, or, if grain, it is deposited by said apron into a box with a sliding bottom, by which it is dropped in gavels; said frame being raised and lowered so as to be adapted for the kind of cutting required, by pins inserted through posts of the frame into the shaft."

The wheel above spoken of is in the form of a reel, having two heads, and vertical rounds, or slats, extending from one to the other; on those rounds or slats the fingers are fixed, while the scythes are on the lower head. The claim is as follows:—

"The invention claimed, and desired to be secured by letters patent, consists in the before-described construction of the wheel for cutting grass, grain, and other articles, and depositing the same upon a revolving apron, which lays it in win-rows, or gavels; in combination with the inclined boards and fingers, box with sliding bottom, and levers and spring for drawing it out and in, as herein set forth. And it is to be understood that the parts separately are not claimed, but only in combination; and in the wheel, the heads and vertical axle are not claimed at all."

Most of the mowing machines which have been made have disappointed the hopes of their projectors, the operation being one of no small difficulty; we are well convinced that the one before us will not steer clear of the objections which have been found to exist in others that have had their brief day, and then expired.

Ship-lifting Machinery, *Meeker and Bergin, Jersey.*—The Patentees say that "the nature of their invention consists in the construction of two vessels, which they call *carriers*, built of such shape that they will adapt themselves to the sides of a ship; that is concave on the side applied to the ship to be lifted, and convex on the opposite sides. Each carrier is built sharp at its two ends, and partly in the form of a crescent, so that when not in use at ships' sides, or when about to be towed to the place where they are to be used, they may be joined together and be secured with heavy iron clasps." These carriers are furnished with chains passing through tubes leading down from their decks to their bottoms, and provided with windlasses, by which they can be hove taught when passed under the vessel to be raised. When used for raising a sunken vessel, the carriers are to be allowed to be filled with water, and sunk, so as to attach them to the vessel, when the water is to be pumped out from them.

"The invention claimed consists in the before described construction of the ship

carriers in sections of the above form, so that they can be united by clasps in such a manner as to present the appearance of a double-pointed boat, which can be towed, floated, or propelled with the machinery required to the place where said carriers are to be used, and then separated, and arranged on the sides of the ship or body to be raised, the chains passing under the same, and made fast to the windlasses on the carriers. Also the combination and arrangement of the pumps, valves, air tubes, windlasses, chains, and rollers, in the manner, and for the purposes set forth."

DESCRIPTION OF PECLET'S NEW ELECTRIC CONDENSER.—BY THE INVENTOR.

This new condenser is composed of three plates of glass, roughened by rubbing the surfaces carefully one upon another. They are entirely covered with gold leaf pasted on with alumine. One of these plates, A, is fixed to a common gold leaf electrometer, its upper surface being varnished. The second, B, is placed on the first; it is varnished on both sides; a small, gilt, unvarnished, copper stem is fixed horizontally at a point in the circumference; it carries in its centre, like the moveable plate of common condensers, a glass stem, which serves as a handle. Finally, on this last plate is a third plate, C, with a hole in its centre, through which passes the stem of the plate B. The plate C, is varnished on the under side only, and its central orifice is furnished with a glass tube which encloses the stem of the plate B, but of a less height.

This apparatus is used as follows: we touch the upper plate with the metal whose action upon gold we wish to determine, and put the plate B, in connexion with the ground:—this connexion is then broken, the plate C is raised, and we touch the plate A. This manœuvre is repeated a certain number of times. Lastly, by means of the stem of plate B, we raise at once the plates B and C; when the gold leaves of the electrometer diverge to a distance dependent on the number of contacts.

The cage which incloses the gold leaves is formed of parallel glass plates, and is placed on a screw tripod, furnished, on one side, with a vertical plate, pierced with a small hole, and on the other with a portion of a divided vertical circle, whose centre is at the same height as the hole of the plate and the upper extremity of the gold leaves: in looking through the hole of the plate we observe the deviation.

To give an idea of the power of this apparatus, I will mention two series of experiments. By touching the upper plate with an iron wire after 1, 2, 3, 4, 5, and 10 contacts, the leaves separated $9\frac{2}{5}$, 20, 25, 31, 41, and 88°. By touching the upper plate with a platina wire, a single contact produced but a feeble deviation, which increased to 15° after three contacts, and to 53° after 20. The experiments with platina were made by using a platina wire which had just been reddened in the flame of alcohol, after washing the hands in distilled water. I had previously assured myself, by a great number of successive contacts in which I touched the upper plate with a finger, that the plates did not contain any electricity.

The new fact of the developement of electricity by the contact of gold and of platina, was also directly proved by means of a simple condenser of extreme sensibility obtained by giving to the coats of varnish a suitable thickness, and rendering their surfaces perfectly plane.

By means of the double and common condenser, I have ascertained that all the metals on which I have operated were positive with respect to gold, and that arranged in the order of their electromotive faculty, in this respect, were ranked as follows:—

Zinc—lead—tin—bismuth—antimony—iron—copper—silver—platina.

The effects produced by bismuth, antimony, and iron, are with difficulty distinguishable.

It is evident, from the disposition of the apparatus, that the quantity of electricity set at liberty, which causes the divergence of the leaves, is proportionate to the number of contacts; now it results from numerous experiments, that as far as about 20° the deviation is proportionate to the number of contacts, hence to this extent the deviation is proportionate to the quantity of electricity. It would be easy to make a table which would give the quantity of electricity corresponding to the deviations which exceed 20°, since these quantities are proportionate to the number of contacts.

Simple condensers, or multipliers, cannot, however, serve to determine the relation of the effects produced by the contact of gold and of different metals, since their relations vary with the thickness of the coats of varnish, as I have satisfied myself by a comparison of experiments with different apparatus.

The instrument which I have described, possessing a sensibility in some sort indefinite, presents to physics a new means of investigation, which I hope may contribute to throw light upon the singular phenomena produced by the contact of bodies.—Ann. Chimie—Franklin Journal Translation.

ANALYSIS OF THE DIFFERENT ASPHALTS—BY M. P. BERTHIER.

The Seyssel.—There are at Seyssel, (in the department of L'Ain) three kinds of minerals.—1. The sandy mineral. 2. The very fusible calcareous mineral. 3. The calcareous mineral of difficult fusion.

The *first* of these melts in boiling water, and becomes detached from the stony matters to which it was adherent. It rises to the surface, or sticks to the sides of the vessel in brown lumps, or forms a transparent coating of a brownish red colour. A rich specimen of it gave

Bituminous oil ..	.0.86	bitumen .106
Carbon	.0.20	
Quartzy grains ..	.690	
Calcareous grains.	.204	
	1.000	

In the mass it is much less rich. When purified by hot water, this bitumen is called *la graisse*, grease.

The *second* variety is called at Seyssel *asphaltum*. It may be pulverized and sifted, but the powder spontaneously forms into balls. The specimen analysed contained .11 of bitumen, 5.89 of carbonate of lime, without clay, and quite pure.

The *mastic* of Seyssel is prepared by mixing nine parts of *asphaltum* with one of the pure *grease* extracted from the sand.

The *third* variety is a compact limestone, in extremely thin, parallel beds.

It consists of

Bituminous matter.....	.100
Argil	.020
Sulphate of lime.....	.012
Carbonate of lime	.868
	1.000

The bituminous mineral of *Belley* is very similar to the preceding. It is found in several communes in very considerable quantities, near the surface of the ground. It is of variable quality. A variable specimen yielded

Carb. of lime	.824
Carb. of magnesia	.020
Sulphate of lime.....	.013
Argil	.023
Bitumen	.120
	1.000

Bitumen of Bastennes.—This bitumen *flows out from several openings or springs, mixed with water. Analysis of the solid gave*

Oily matter.....	.200	bitumen
Carbon	.037	
Fine quartzy sand, mixed with argil.....	.763	
	1.000	

Bitumen of Cuba.—This is transported to Europe under the name of *Mexican asphalt*, or *chapopote*. It is a solid bitumen, which exists in abundance near Havana. It may be used with great advantage in paving. It consists, like the greater number of natural bitumens, of at least two different substances, the one soluble, and the other insoluble in ether and spirits of turpentine. It is the relative proportion of these two substances which imparts to each bitumen its peculiar properties.

Bitumen of Monastier (Haute-Loire.)—This does not soften in the least in boiling water, and hence cannot be extracted by simple means in the large way. It contains:—

Bituminous oil	.070	.105
Carbon	.035	
Water	.045	
Gas and vapours.....	.040	
Quartz and Mica	.600	
Ferruginous argil	.210	
	1.000	

This bitumen of the Haute-Loire differs essentially from those of Seyssel and Bastennes by its infusibility in boiling water, and its fusibility in alcohol.—*Annales des Mines—Franklin Journal Translation.*

ON THE USE OF THE GALVANIC BATTERY IN BLASTING.

[To the Editor of the *Philosophical Magazine.*]

Sir,—I beg to trespass on your time by this letter on the use of the galvanic battery instead of the fuze, in blasting.

The papers have given short descriptions of the experiments made at Chatham, but all the details were not given. I commenced my experiments on blocks of the old trees that were blown down by the late storm. I first prepared an igniting cartridge by joining two pieces of clean copper wire to the extremities of a steel wire taken from the scratch brush, such as is made use of by gun-makers: this steel wire is fastened to the copper wires by waxed silk; the length of steel wire to be deflagrated is one-fourth of an inch; a piece of very slight wood is spliced to both copper wires to protect the steel wire from any accident—it makes the whole strong, and more convenient to be introduced into the small

cartridge, which is either a quill or a small paper tube. They are filled with fine powder, and made air and water-tight, to prevent the powder from getting damp, and rusting the steel wire; a second small piece of wood is then fastened to this small cartridge and the copper wires; one of the wires is bent over this piece of wood, and brought up at an angle with the other upright wire. This is my exploding cartridge; it cannot be easily put out of order. The wires of the cartridge have only to be made bright before they are fastened, by twisting them round the positive and negative wires of the battery. I always place the cartridge deep in the hole made to receive the powder, in order that the pressure from the turnpeg may be taken off by the quantity of powder above it.

The wire I make use of is the common copper bell-wire. The battery is the old Wedgewood trough, with 4-inch plates, double coppers. I prevent the zinc plates from touching the copper by small pegs of wood passed through the four corners. Wooden troughs with moveable divisions were tried, but not with any good result. A wooden trough with the plates in a frame of wood, with varnished paper between the copper, was tried, but the porcelain trough far surpassed them. My first experiment was blasting single blocks; the effect was much better than when the fuze was used, in consequence of the clay being more firmly driven round the wires than it would be round the larger surface of the fuze. Secondly, I selected two large blocks nearly in line; the first block was 43 feet from the battery; the second block 113 feet from the battery, and the blocks, consequently, were 70 feet from each other. On dipping the plates the explosions took place in quick succession; the battery consisted of 30 pairs of 4-inch plates. Thirdly, I wished to try the effect of a simultaneous explosion of two blasts on a very large block firmly tied together by rivets. The positive wires of each cartridge were fastened to the positive connecting wire, and in like manner the negative wire. The effects of this simultaneous explosion were very good; the exciting liquor being weak, the connecting wires were shortened to 98 feet. Fourth. To amuse some friends, I exploded some powder in one of the ponds, depth 10 feet; length of wire, 210 feet; 40 pairs of plates, with old exciting liquor: the experiment succeeded to the delight of all; a large eel was killed by the blow-up. I have no doubt but that wild-fowl will yet be killed by means of shells placed at low water on the banks where they feed; and by means of long connecting wires, the shells can be made to explode simultaneously among the birds.

I find that 10 pairs of 4-inch plates free from oxide, and charged with the following exciting liquor—water, 6½ quarts: sulphuric acid of commerce, 4½ ounces; nitrous acid, 4½ ounces; will ignite powder with a wire 101 feet long—20 pairs of plates ignited powder at the distance of 353 feet. I tried to repeat this experiment, but did not succeed, though the plates were only three times immersed in the acid, and only for about two seconds each time. I tried the same battery at 268 feet, and did not succeed. The plates were then well washed, and fresh exciting liquor made; the experiment again failed; the plates were quite inactive. The next day I tried the same plates and the same exciting liquor, and succeeded at 268 feet. From this it seems impossible to say how many pairs of plates would be required to produce uniform effects at long distances. I suspect that the zinc plates do not act equally in producing the electricity, which causes this variation.

I should have liked very much to have tried the conducting properties of different sized wires, but had not an opportunity of getting them here.

Not having seen any notice of this novel and safe method of blasting in your excellent journal, induced me to send you these few remarks.

I believe I am the first in Ireland that applied the galvanic battery instead of the fuze in blasting.

I remain, Sir,
Yours &c.,
HAMILTON K. G. MORGAN.

Johnstone Castle, Wexford.

THE IMPROVED SHAKER.

A few weeks since, we stated that Mr. Robert Shennan, farmer, Lairdlaugh, parish of Kirkpatrick-Durham, in the Stewartry of Kirkcudbright, had invented a shaker for his thrashing-mill, on a new principle, and which had been deemed by competent judges a decided improvement on the one at present generally in use. The invention, ever since it was made known to the public, has excited no small degree of attention, judging from the number of farmers and millrights who have visited it—several of them residing at the distance of upwards of fifty miles, and who, after a strict examination, expressed themselves in its favour; and we understand that Mr. Shennan has forwarded an account of it to the Highland Society, which, we have little doubt, will also regard it as worthy of recommendation, and even perhaps mark their sense of its importance by conferring some mark of respect on its worthy author. The following

escription of the shaker has been kindly furnished us by Mr. Shennan himself:—

"My shaker is an instrument of the same width as the machine, and about 4½ feet long. The sides which run from the machine outward are ¾ boards, about 4 inches deep, with a flat bar across at each end to which the bottom, which is parallel rods, is nailed. The rods are ⅝ inch thick, ⅝ apart (but I think they would do closer), and about an inch deep. The end of the shaker is attached to the machine by hinges, and the straw is thrown on it by the rake. The other end is suspended by wooden rods from a spindle of inch iron cranked at each end—1¼ inches giving the shaker 2½ inches of throw. The shaker has a small bolt on each side, which runs into a hole in the rods by which the shaker is connected with the crank. I have several holes in the rods by which I give more or less declivity. That which I mostly use is about 1 foot in 3. The bolts are about 1 foot from the extreme end. The motion is raised from the spur-wheel by a pinion on a shaft, on which also there is a pulley, and another on the end of the crank-spindle turned with a rope over them, giving about the same motion as fanners require (the fanners are driven from the same shaft.) The bottom of the rake might be taken out and the shaker introduced, in which case room might be saved; and in many cases the shaker might be driven by a pinion on the crank-spindle attached to the spur-wheel. Should there not be room for the shaker between the rake and fanners, a small rake, just sufficient to relieve the drum of the straw, with a little more motion, might do. By putting a close bottom on the shaker, 2 or 2½ inches below the rods, the grain would run into fanners with almost no hopper.

"My shaker works most pleasantly and efficiently, though I have no doubt but it may be improved. But I am confident I have found out the principle; for the shaker can be made longer giving the straw more time—the crank can be enlarged, giving it more shake—or more motion can be given, which will shake it oftener."—*Dumfries Times.*

LAW OF PATENTS.

The following is a copy of a Bill now in its progress through Parliament for the amendment of a particular defect in the last Patent Law Amendment Act; it passed the Commons on Thursday last:—

"Whereas by an act passed in the fifth and sixth years of the reign of his Majesty King *William the Fourth, intituled* "an Act to *amend the Law touching Letters* Patent for *Inventions,*" *it is amongst other things* enacted, that if any person having obtained any letters patent as therein mentioned shall give notice, as thereby required, of his intention to apply to his Majesty in council for a prolongation of his term of sole using and vending his invention, and shall petition his Majesty in council to that effect, it shall be lawful for any person to enter a caveat at the Council Office, and if his Majesty shall refer the consideration of such petition to the Judicial Committee of the Privy Council, and notice shall be first given to any person or persons who shall have entered such caveats, the petitioner shall be heard by his counsel and witnesses to prove his case, and the persons entering caveats shall likewise be heard by their counsel and witnesses, whereupon, and upon hearing and inquiry of the whole matter, the Judicial Committee may report to his Majesty that a further extension of the term in the said letters patent shall be granted, not exceeding seven years, and his Majesty is thereby authorised and empowered, if he shall think fit, to grant new letters patent for the said invention for a term not exceeding seven years after the expiration of the first term, any law, custom, or usage to the contrary notwithstanding; provided that no such extension shall be granted if the application by petition shall not be made and prosecuted with effect before the expiration of the term originally granted in such letters patent:

"And whereas it has happened since the passing of the said act, and may again happen, that parties desirous of obtaining an extension of the term granted in letters patent of which they are possessed, and who may have presented a petition for such purposes in manner by the said recited act directed, before the expiration of the said term, may nevertheless be prevented by causes over which they have no control from prosecuting with effect their application before the Judicial Committee of the Privy Council; and it is expedient therefore that the said Judicial Committee should have power, when under the circumstances of the case they shall see fit, to entertain such application, and to report thereon, according to the provisions of the said recited act, notwithstanding that before the hearing of the case before them the terms of the letters patent sought to be renewed or extended may have expired:

"Be it therefore enacted, by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons in this present Parliament assembled, and by the authority of the same, that so much of the said recited act as provides that no extension of the term

of letters patent shall be granted as therein mentioned, if the application by petition for such extension be not prosecuted with effect before the expiration of the term originally granted in such letters patent, shall be and the same is hereby repealed.

"And be it further enacted, that it shall be lawful for the Judicial Committee of the Privy Council, in all cases where it shall appear to them that any application for an extension of the term granted by any letters patent, the petition for which extension shall have been referred to them for their consideration, has not been prosecuted with effect before the expiration of the said term from any other causes than the neglect or default of the petitioner, to entertain such application, and to report thereon as by the said recited act provided, notwithstanding the term originally granted in such letters patent may have expired before the hearing of such application; and it shall be lawful for her Majesty, if she shall think fit, on the report of the said Judicial Committee recommending an extension of the term of such letters patent, to grant such extension, or to grant new letters patent for the invention or inventions specified in such original letters patent, for a term not exceeding seven years after the expiration of the term mentioned in the said original letters patent: provided always, that no such extension or new letters patent shall be granted if the petition for the same shall not have been presented as by the said recited act directed before the expiration of the term sought to be extended, nor unless sufficient reason shall be shown to the satisfaction of the said Judicial Committee for the omission to prosecute with effect the said application by petition before the expiration of the said term.

"And be it further enacted, that this act may be altered, amended, or repealed by any act to be passed in the present session."

WHEELS FOR RAILWAY CARRIAGES.

(From the Railway Times.)

Sir,—Having had considerable experience in matters connected with railways, I have watched very attentively for a considerable time the operations of various descriptions of wheels used upon the carriages, in order to ascertain as nearly as I could which description of wheel is the safest, and will run the greatest number of miles with the least repairs.

It is hardly necessary to say anything about cast iron wheels, as it has been long decided by those who have had the greatest *experience in this* matter that although very *good wheels may be* made of cast iron, yet the uncertainty that is inseparable from articles made of that metal, renders them very unfit to be used for the conveyance of passengers, and the Railway Companies are now generally replacing them as they break and wear out, with wrought iron wheels, not only for the coaches but also for the conveyance of merchandise, as in addition to the increased safety, they are found to cost less in wear and tear and do less mischief to the rails. The tire of a cast iron wheel expands so much more than the wheel itself by the variations in the temperature of the atmosphere as to cause it to work loose and no mechanical combination can obviate this defect.

There are five different descriptions of wrought iron wheels which have principally come under my notice.

1st. A wheel called Hawk's consisting of straight spokes forming radii from the centre, with an inner ring having holes cut through it into which each spoke fits without any fastening. The flanch tire is shrunk on the inner ring in the usual way, and the ends of the spokes come in contact with the inner part of the tire and abut against it, the inner ring is not welded, but the ends abut against each other; it is evident that this is merely a pressure wheel, and that the weight which it has to carry rests only upon those spokes which are below the centre of the wheel; one half of them are therefore quite inefficient for the purpose of carrying the load, and should the tire come off, or a fracture take place, the whole strength of the wheel is at once gone and may cause considerable difficulty and delay (to say the least) in the passage of a train.

2nd. A wheel called Bramah's composed of spokes bent into a pear-like shape with an inner ring having a projecting rib on it, which fits into a groove formed in rolling the spoke, the spoke having no other fastening to the inner ring; this is certainly the prettiest wheel (I have seen) in appearance, but this wheel has not the advantages of suspension, and therefore one half of the spokes only as before named are efficient to carry weight and the wheel is is likely to work loose, and become very troublesome.

3rd. A wheel manufactured I understand at Leeds in which the spokes are formed like the letter T, the ends that go next the inner ring abutting together, the inner ring of the wheel is then shrunk on which brings all the ends of the spokes in contact, and a rivet is put through the end of each spoke near where they come together, and the tire is shrunk on in the usual way; this seems to be a much better wheel than either of those which I have already described, because it does get some of the advantages of a suspension wheel although in an imperfect manner in com

quence of the rivets which fasten the spokes to the inner ring being at a considerable distance from the spoke itself; nevertheless this wheel is found to work pretty well, and will perform a fair average distance without much repair.

4th. A wheel called Losh's which has no inner ring, the spokes being formed by making 2 bends or angles in a piece of bar iron, the part between the bends forming a segment of a circle upon which the tire is put, and there is a bolt or rivet put through the middle of every segmental spoke, in order to fasten the tire to the spokes; this wheel cannot have the advantages of a suspension wheel, because the bolt or rivet before named, is at such a distance from the spoke as to have no power to prevent the spoke drawing away from the tire, therefore one half of them have no portion of the load, and if the tire break or come off, the wheel is at once rendered loose, because there is no inner ring and the wheel will not retain its circular form. The tire of this kind of wheel is also liable to flatten between the spokes, thereby injuring both the wheel and the nails.

5th. A wheel called Hague's, formed of spokes of a pyramidical form, each being made of 2 pieces of iron welded together at the part which fits against the inner ring of the wheel which is welded up and forms one piece, and having also a nipple that goes through the inner ring and is firmly riveted to it into a deep countersink, so as to make the end of the spoke quite flush with the outer part of the inner ring. The spoke has also a large shoulder which abuts against the inner ring, and the end of every spoke where it joins the nave of the wheel abuts against the next spoke, forming a complete truss. It will be seen that let the spokes be placed in any position as the wheel revolves, each of them does an equal share of the duty, those spokes above thecentre forming suspension bars, those which are horizontal forming ties, and those which are under the centre taking the same proportion of the weight as those which are above, and if the tire should come off or break the strength of the wheel is still unimpaired; the use of the flanch tire being merely to keep the carriage on the line, and to be easily replaced when worn out, but not to form any part of the strength of the wheel, which in all cases should be quite efficient for the load, without deriving any assistance from the tire at all.

My object in sending this communication is, that the attention of Railway Companies may be drawn to this subject, which forms, in my opinion, one of the most important *items in their current expenses.*

Your most obedient servant,

A RAILWAY ENGINEER.

PROGRESS OF ELECTRO-MAGNETISM—STEAM SUPERSEDED.

The Emperor of Russia lately appointed a commission to inquire into the applicability of electro-magnetism as a moving power, and from an official report by this commission, the substance of which is given in the last number of *The United Service Journal*, it appears that Professor Jacobi has actually succeeded in impelling a vessel by electro-magnetic power.

The vessel was of that species of galley which is well known in the Russian navy; its measurement, 26 feet in length and 8½ in width. On smooth water it was impelled at the rate of more than 3 feet per second of time, or somewhat above 2 miles per hour; and the average of a number of experiments was from 2 to 3 feet per second. It performed a distance of rather less than 5 miles along the Neva and the town canals in about 2½ hours. The space occupied by the machinery was 1 foot 2 inches in breadth and 2 feet 1 inch in length. The galvanic batteries, consisting of 320 pairs of plates, were arranged along the sides of the vessel, within which twelve persons were seated at their ease. These batteries were used several days consecutively, and did not exhibit any diminution of power. The experiments which have been made have opened out much that was unknown on the subject both of electricity and magnetism, with regard to their practical bearings, and suggested the introduction of very considerable improvements in the construction of the machinery upon a larger scale. From two to three months were consumed in the various trials hitherto made, but as yet they have not been sufficient to determine what quantity of zinc a machine will require per day to every horse-power, or how much of it will be converted into vitriol; it was ascertained, however, that the plates, whose whole weight was originally 400 lbs. and superfices 96 feet square, had not lost more than 24 at the termination of the experiments.

An American gentleman, (Capt. Taylor), is now in London, who states that he has been equally successful in applying electro-magnetism, as a driving power to machinery on shore. As he is taking out a patent for his method, we cannot at present say more than that, from the description of it which the inventor has communicated to us confidentially, we are disposed to place great reliance on its efficiency.

THE BRITISH QUEEN.

We are glad to learn that this splendid vessel arrived on the 28th ult. safely at New York, after a passage of 15½ days from Portsmouth. She started on her return voyage on the 1st inst., and is hourly expected in the river. The *Great Western* which sailed half an hour before her, has already arrived in Bristol. The following abstract of the log of the British Queen on her outward voyage is given in the *New York Courier and Enquirer*.

Abstract.

July 12.—Sailed from Spithead at 1 p.m. Wind W.S.W.

July 13.—Lat. 49 32, long. 5 45, St. Agnes lighthouse N.E. 9 leagues. Distance run, 235 miles.

July 14.—Wind W.N.W. to S., lat. 49 34, long. 11 22. Moderate and cloudy. Distance 218 miles.

July 15.—Wind W.N.W., lat. 49 23, long. 15 50. Strong breezes. Distance 181 miles.

July 16.—Wind S.W. by W. and W., lat. 49 20, long. 21 18. Fresh gales and squally, head sea. Distance 210 miles.

July 17.—Wind N. and N.N.W., lat. 48 6, long. 25 46. Strong breezes, with head sea. Distance 198 miles.

July 18.—Wind N. by W., lat 46 56, long. 30 10. Strong breezes, with head sea. Distance 193 miles.

July 19.—Wind N. by W. and N.W., by W. lat. 46 13, long. 34 47. Moderate breezes, with swell. Distance 198 miles.

July 20.—Wind W.N.W., lat. 45 30, long. 39 1. Strong breezes and fresh gales, head sea; ship very easy. Distance 182 miles.

July 21.—Wind W.N.W., lat. 45 4, long. 42 1. Fresh gales, with increasing sea. Distance 130 miles.

July 22.—Wind W.N.W., lat. 44 43, long. 46 27. Moderate breezes. Distance 190 miles.

July 23.—Wind W.S.W., lat. 43 42, long. 51 2. Light and fresh breezes. Distance 214 miles.

July 24.—Wind W. by N., lat. 43 17, long. 55 40. Fresh breezes and squally. Distance 207 miles.

July 25.—Wind N.W., lat. 42 23, long. 60 30. Light breezes and cloudy. Distance 221 miles.

July 26.—Wind W. and W.S.W., lat. 41 14, long. 65 34. Moderate breezes and fine. Distance 240 miles.

July 27.—Wind N. and variable, lat. 40 19, long. 70 35. Moderate and fine. Distance 240 miles.

STEAM CARRIAGES ON COMMON ROADS.—COL. MACERONI IN REPLY TO MR. HANCOCK.

Sir,—I have hitherto abstained from troubling you with any notice of the letter which appeared, from Mr. Hancock, in your publication of the 20th of last month; because it seemed to me useless to occupy your columns with a controversy, the subject of which has been, and will speedily be again, decided in a practical manner. I considered that after the public working of my carriage in the years 1833 and 1834, with the abundant and impartial testimony of the public press, the appeal of Mr. Hancock to "deeds not words," was (and I do not speak uncivilly) unworthy of notice. But as you have since inserted, with marked approbation, an article from the *Cambridge Independent Press*, strongly urging the attention of its readers to what the editor is pleased to call "Mr. Hancock's clear and impartial statement"—but which is really no more than Mr. Hancock's own view of his own case, I am urged by friends to appeal to *your* impartiality for the insertion of a very few remarks upon the subject of that statement.

In the first place as to the *deeds;* I refer to the reports which have been published from time to time in the *Times*, *Morning Chronicle*, *Globe*, *Sun*, *Courier*, and *True Sun* newspapers, of the actual performances of my carriage daily, for eighteen months, from Oxford-street and Paddington, to Harrow, Edgware, Uxbridge, &c., upon the softest and hilliest roads in England. The statements referred to in those papers were never in a single instance solicited, or in any manner prompted by me. They were on all occasions the result of the unbiassed observation of the editors or official reporters of those papers. I have a right to observe in this place that I have never seen one report of *similar* authority—or one such circumstantial and detailed account from *any* authority, respecting Mr. Hancock's "deeds." The published testimony of the Marquis of Tweedale, Mr. Wallace, M.P., Mr. Leitch Ritchie, and a host of other equally impartial gentlemen, amongst whom are several engineers, is also, in every instance, precise, circumstantial, and detailed, respecting m

"deeds"—that is, as to the length and nature of the roads, and the speed of the carriage, mile for mile in each trip.

Those deeds of mine also, were all performed with *one* carriage. Mr. Hancock's deeds—that is the running of one carriage daily (or rather irregularly) upon the New-road—were performed with twelve carriages. I mean to say distinctly, that with twelve carriages, he could keep only *one* carriage running, upon that short and easy road; and that he did not do that regularly or for more than a few weeks at a time, with intervals of from six to twelve months.

Mr. Hancock has now fourteen carriages, according to his own statement, and he says "he is ready." What need of "words?" They are waiting with open eyes for his "deeds," and with open arms for his carriages at Birmingham and Cambridge. When I have *one* carriage, which will be *very* soon, I shall go daily to Birmingham — or to Cambridge and back, daily. What my former carriage (of which I have been robbed by a conspiracy) has done, is a guarantee that the new and very far *superior* carriages will furnish "deeds" enough to be appealed to, upon all the roads in England.

Repeating, that if Mr. Hancock be ready, he can settle the matter as respects *his* deeds and words, by taking a carriage down to Birmingham, as I shall do when I am ready, in a public manner, and at a regular and sufficient speed, I take my leave of the discussion, and I am, sir,

Your obedient servant,

MACERONI.

August 12, 1839.

NOTES AND NOTICES.

Sir James Anderson's Steam Carriage.—We are authorised to state that the arrangements for testing the merits of Sir James Anderson's steam drag, are in such a state of forwardness as to ensure the ultimate result being made known to the public in a very short period from this time.

New Comet.—The following notice of a new comet, visible only through the telescope, is given by the *Notizie del Giorno* of Rome of the 18th inst.:—"It first appeared in the tail of the dragon, and may now be seen between the stars Kappa and Lambda. When discovered on the 14th it was confounded with a nebula, extremely weak, and it will be in vain to search for the comet until this nebula has been made out."

A New Method of Securing Property from Fire.—The most effectual plan, out of the many contrivances for preserving papers and other valuables from the destructive ravages of fire, has been by sinking a well about fifteen feet deep, and lowering the property into it, and then securing the top with an iron door. This plan, however, has been but little adopted in consequence of the enormous expense required for the requisite machinery,—the great manual labour required,—and the frequent repairs which are found to be necessary. Our attention has been called to a novel and ingenious apparatus for this purpose, which has just been patented by Mr. Chubb, the lock-inventor, and which seems to obviate all the defects of former machines. It appears that one man can raise or lower an iron safe of two tons weight into a well 15 feet deep, in the space of five minutes. We have seen a model of the machine, and were struck with its great simplicity and security. The invention must, we think, be indispensable to bankers, as it also gives perfect safety from burglars, the door at the top having a lock to throw bolts all round.—*Manchester Chronicle.*

Wire Sewn Boots and Shoes.—M. Sellier of Paris, has secured by a patent in France the right of using brass wire for attaching the upper leather to the welt of shoes and boots. He urges that this metallic thread allows neither moisture nor dust to enter the shoe, and further more that it does not rip. The sewing is performed with as much ease, as with waxed thread, nor is the work more costly. A member of the committee has worn a pair of Sellier's boots 18 months, in which time two strong soles were worn out, without any giving way whatever of the wire sewing. They were free from dampness, and from dust in a time of drought.—*Bull. d'Encour. Sept.* 1838.

Red Colour of Salt Marshes.—When sea water is subjected to spontaneous evaporation, the commencement of the deposition of salt is known by the appearance of a light red scum. A reddish tint is observable also in the salt when collected in heaps, and it then emits an odour somewhat like violets. This colouring is occasioned by little crustaceous insects of the order of branchiopodes, and genus *Artemia.* These little animals, about a third of an inch long, have the form of a very thin cylindrical or vermicular tube, furnished with two little antennæ and two round and elevated black eyes, with a narrow mouth under the eyes. They have 22 swimming legs, which take up half their length. They move with prodigious rapidity, but perish when the solution acquires the density of 25°. Their bodies then become red, and float over the surface in the form of a scum.—*Annales des Mines.*

Public Enterprise in America.—An American correspondent of the *Athenæum* gave the following estimate of the canals and railways completed, commenced, or authorized, in the State of New York alone:—

	Miles.	*Dollars.*
Canals and railroads finished ..	995	19,447,711
Canals and railroads commenced	1,134	23,750,000
Canals and railroads authorized.	1,704	31,064,000
Erie canal and enlargement, authorized, say.....		23,000,000
Total canal and railroads	3,833	96,251,711

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 837.] SATURDAY, AUGUST 24, 1839. [Price 3*d.*

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

RODDA'S SMOKE BURNING AND FUEL-SAVING APPARATUS.

Fig. 2.

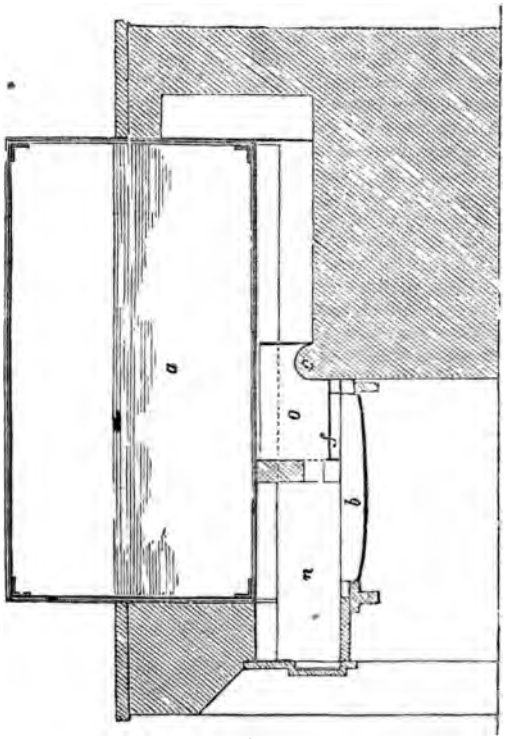
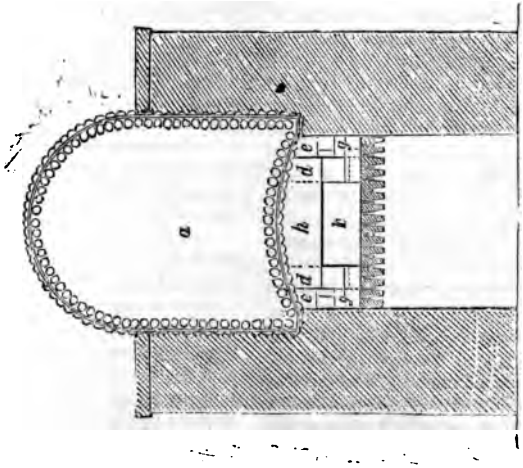


Fig. 1.



RODDA'S PATENT SMOKE BURNING AND FUEL SAVING APPARATUS.

If smoke be still one of the greatest nuisances of this coal-burning country, and one of the most costly too—for one-fourth of all the coal consumed is supposed to be wasted on blackening and fouling the atmosphere we breathe, and (do contrive somehow or other to) live in it cannot be said to arise from any lack of plans for its prevention. We have in the course of our labours described a good many in our pages, and of these not a few seemed to us of excellent promise, though from some cause or other (the difficulty of overcoming old and settled habits, perhaps as much as any thing else) none of them have as yet been more than partially adopted. We have now to add to the list of smoke preventers, one by Mr. Rodda, of Cornwall, which comes before us with so many strong testimonials in its favour, from respectable parties by whom it has been tried, that we do but our duty as stewards of the competition in giving it a *place*. Several may be said to be *nowhere*, but this, undoubtedly, is amongst those which bid fair to win. It has been on trial for some months at the breweries of Messrs. Truman and Hanbury, Messrs. Combe, Delafield and Company, and Messrs. Neville, Reid and Co. (Windsor), as well as several other places of lesser note. The managing brewer and resident engineer at Truman and Hanbury's, certify that the apparatus, not only consumes the smoke effectually, but produces a saving of from 9 to 11½ per cent. in coals. The brewer at Combe, Delafield and Co.'s, considers it to be "more simple and effectual than any he has yet seen." The manager of the Windsor Brewery attests, that by means of Mr. Rodda's apparatus "every one of the chimnies may be kept quite free from smoke by proper attention on the part of the stokers." And for what neighbours say and think of it, we may quote the following kind note from the worthy Dean of Windsor:—

"I hereby certify with much pleasure, that Mr. Rodda's plan for causing the diminution of large volumes of black smoke *issuing from brewhouse* chimnies appears to *answer the purpose* for which it was intended. *For the seats* and benches in a *garden adjoining Mr.* Neville Reid's brewhouse in Windsor, are no longer covered with blacks; which before Mr. Rodda's plan was carried into effect were much complained of, and were always a great annoyance. The flowers and shrubs grow better and the grass is cleaner.

"H. L. HOBART,
"Dean of Windsor.

"August 15, 1839."

Mr. Rodda's apparatus is more like that of Messrs. Chanter and Co.'s than any other we can call to mind; and perhaps it would be difficult to point out any very material difference either in principle or detail between them. We leave the two parties however to settle that point between themselves, and proceed to give Mr. Rodda's own description of his invention.

The principle of this invention consists in certain arrangements of furnaces and fire-places, by which the smoke from the more recently introduced fuel is made to pass through or amidst that portion of the fuel which has been longest ignited, and is still in a state of vivid combustion, and under or through the flame of the fuel more recently ignited, whereby a portion or the whole of the inflammable matter or particles of which the smoke is composed, becomes ignited and effectually consumed.

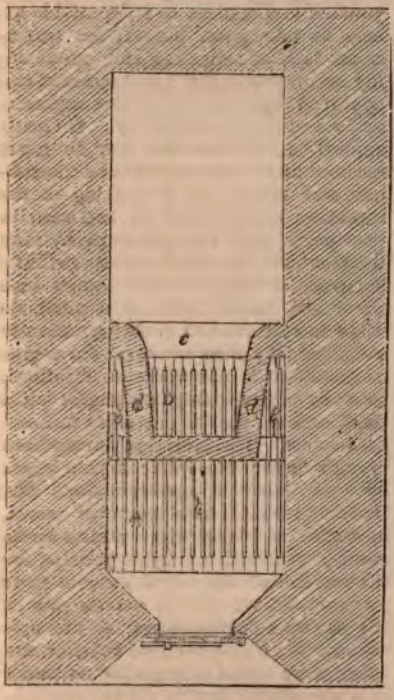
The prefixed engravings represent the invention as applied to a waggon boiler; but the plan is applicable to almost every fire-place or furnace.

Figs. 1, 2, and 3, represent the invention as adapted to an ordinary waggon-shaped boiler; fig. 1, being a transverse section through the fire-place, and an end view of the boiler; fig. 2, a longitudinal section of the fire-place and boiler; and fig. 3, a plan or horizontal section of the fire-place.

a, is the boiler; *b*, the fire-bars; *c*, the ordinary fire-bridge; *d d*, two walls, formed of welch lumps, and extending from the bridge towards the fire-door, about two-fifths of the length of the fire-bars, and about four inches distant from the sides of the fire-place, so as to form the two small side flues *e e*, which are open at the front end, but closed at the hinder end by the bridge being at that part continued up almost to the bottom of the boiler. The walls *d d* are at their upper side nearly in contact with the bottom of the boiler, and are supported at each end by pieces of fire

brick or lumps, resting on the fire, or on the sides of the furnace, so as to leave a narrow aperture or slit, *f*, of about four inches in depth, (or more, according to the size of the fire-place.) between the under side of the wall, and the top of the fire-bars; *g*, is a brick at the mouth of each of the side flues, *e e*, to prevent the ashes from entering into and choking the flues; *h*, is an arch, extending from the one wall, *d*, to the other wall, *d*, and

Fig. 3.



leaving, between its under side and the top of the fire-bars, a free space or passage, *k*, of from eight to ten inches in depth, whilst the top of the bridge is nearly in contact with the under side of the boiler.

The fire-place is divided into two parts, or compartments, *n* and *o's*, the compartment *n*, which is nearest to the fire-door, is denominated the *fire box*, and the compartment *o*, which is nearest the bridge, the *smoke-burner*.

The fire-box contains the most recently introduced fuel, and the smoke-burner that which has been longest in the furnace, and, therefore, in the most perfect state of combustion. The effect of this arrangement is, that the smoke given out from the fresh fuel, enters into the side flues, *e e*, and passes through the slit or aperture into the midst of the fuel and under or through the flame from the fuel in the fire box, which sweeps under the arch into the smoke-burner, whereby the smoke becomes consumed, and a very considerable quantity of coals is saved.

To the advantages of consuming smoke and saving of fuel ought to be added, the preservation of boilers and coppers, or any metallic vessel under which this apparatus may be placed. It is well known that the great fires commonly used in steam-engine and other large furnaces throw out their gases with great vehemence—for a few minutes after new coals are introduced—and that when those inflammable gases are exhausted, there is a very intense heat dashed against the bottom of the boiler or copper, which continues until fresh fuel is introduced. In consequence of this intense heat, (especially when given out by Welsh coal) it is too often the case that coppers and boilers are very much injured. It is not to be denied, that where the process of combustion is very gentle, and the fire is allowed to burn slowly, as in the case of the large Cornish boilers, which bear the proportion of near half a ton of boiler to each horse power of the engine, Welsh coal may be of greater benefit than English; but where the fire is forced and raked, the Welsh coal is frequently found to oxidize the metal, according to the quantity of sulphur contained in the coal. On the other hand, to burn English coal, without being able to lay hold of the inflammable gases or smoke is a source of great loss, in forced fires, and in many places a very great nuisance. Now from what has been effected during the last six, eight, or ten months past in different places by Mr. Rodda's Patent Smoke Consumer, it seems very probable, that instead of the metal being injured, it is actually preserved. Startling as this conclusion may appear, it is justified by the following considerations:—1st, Mr. R.'s fire-place should be regarded as a repository for both coal and coke, and yet possessed of but one fire, and fed with coal only. The partial division in the fire place is

so constructed, that one part of the same fire-bars are allowed to contain coke or well carbonized fuel, and the other part of the bars nearest the fire-door to contain the new coals; *and the whole* of the time the well caked part of the fire is throwing out its heat or flame, the smoke or gases (which are of *themselves cold, until ignited by the heat of the inner part of the fire*) are laid hold of, either by being dragged through the hot coke or under flame, and when the smoke comes up against the flame (for it will not remain long under it) it is while passing over the bridge ignited. The consequence is, that while the coke is throwing out its greater heat the cold gases from the coals lessen very considerably the intensity of the flame, while they mingle together and play against the boiler. It has been observed by many, when looking at this apparatus in full operation, that while there has been no smoke the flame has been very gentle and not calculated to injure either copper or boiler.

It may be further remarked, that when there is a large quantity of coke in the inner part of the furnace, there will always be a correspondingly large quantity of coal in the outer part, so that the gas will continue to be thrown out from the coal as long as there is a fair heat produced from the coke; this cannot be well avoided by the stoker, and it must always be the case as long as he keeps the whole of his fire-bars covered; and hence it follows, that by drawing the smoke through the coke from the sides of the furnace, and bringing a part of it under flame, the whole of the time, the heat must be uniform and not so liable to do an injury as the common fire places.

MESSRS. BUNNET AND CORPE'S PATENT CONCENTRIC STEAM-ENGINE.

Sir,—In the last number of the *Mechanics' Magazine*, there is a communication from a correspondent signed W. P., professing to be a translation of part of a letter from a foreigner relative to our Patent Concentric Steam Engine, which being utterly false, is in our opinion, and *that of many of our friends* calculated to *do much harm if suffered* to pass *uncontradicted. We shall* therefore feel *much obliged by your* insertion of this letter. At the same time, we cannot help expressing our surprise that such an article from an anonymous correspondent should so readily be admitted into the colums of a publication of the character and circulation of the *Mechanics' Magazine*. Your correspondent, who we find is a Mr. Pole, of Windsor Terrace, City Road, has endeavoured to ridicule and cast a slur upon an invention, evidently much above his comprehension. Who, and what Mr. Pole is, it does not seem easy to ascertain, but we leave to yourself and readers to judge of his fitness to take upon himself the ungracious task of ridiculing and condemning an invention that has been seen and approved by many of the first engineers and scientific men of the day. On being applied to, he admitted that he never received any communication on the subject, and that he knew nothing of the invention beyond what he had seen in your pages, and that although he took the trouble to furnish diagrams (wilfully incorrect as regards our engine) with the article, he did not think it worth his while to avail himself of the opportunity we afford all parties of seeing the engine in operation at our works at Deptford, or even of inspecting an engine on a small scale on view at our office in Lombard-street. The invention having been brought before the public in your pages by your talented correspondent, Mr. Baddeley, would, as a matter of course, invite fair and legitimate criticism on its merits, or furnish a subject perhaps for the exercise of the wit of some of your correspondents; to this we do not in the slightest degree object, as the opinion of W. P., or William Pole, or any other party would only go for as much as it was worth; but in the communication in question, an air of probability and truth is given to most injurious assertions, and be it remembered, all the readers of the *Mechanics' Magazine* are not engineers or scientific men capable of judging of the merits of a steam engine, although many of them may use or require one. We are at a loss to guess the motives of Mr. Pole, if it appears that he is the tool of other parties, he must answer for them elsewhere.

We are sorry to occupy so much of your valuable space, but must beg of you to state, that we have not at present sent out an engine to any party whatever,

nor is it our intention to do so until we have fully satisfied ourselves and the public as regards power, capability of speed, economy of fuel, &c., in an engine we shall shortly have in action of greater power than the one now in operation at our works. In the mean time, we shall be most happy to test the performances of the present one with any other engine.

We are, Sir,

Your obedient servants,

BUNNETT AND CORPE.

26, Lombard-street, City, August 21, 1839.

P. S.—Some excuse may possibly be allowed, as the thing does not appear to be well understood, even in some quarters where we should expect sounder judgment—witness the similarity that has been asserted to exist between ours and Scobell's engine, published in your 834th Number.

BUNNETT AND CORPE'S PATENT CONCENTRIC STEAM-ENGINE VINDICATED FROM THE MISREPRESENTATIONS OF MYNHEER VAN HOOMBOOGD.

Sir,—It is with much regret I observe a portion of this day's Magazine occupied by an attempted burlesque of Messrs. Bunnett and Corpe's recently patented concentric steam-engine. The writer, who adopts the appropriate cognomen of "one humbug," and writes himself down an A.S.S. into the bargain, may call his manner of treating the subject, "*romancing*," but, in plain English, it is neither more nor less than "*downright lying*."

Having had the pleasure of bringing Messrs. Bunnett and Corpe's invention before your readers in the first instance, I feel myself called upon to notice the very unhandsome manner in which it has been attacked. It is almost needless for me to observe that Messrs. Bunnett and Corpe's "*details of experiments*," are only a few weeks old; and that no steam-engine on their construction has yet been delivered. Two engines, only, have hitherto been completed; the first one is employed at their works at Deptford, the second (which is of smaller power) is still to be seen at the patentees office, in Lombard-street, City.

I would beg to state, that Messrs. *Bunnett and Corpe* have come fairly before the public; they have plainly and explicitly stated the grounds upon which they claim a certain superiority for their new steam-engine; they have fully detailed their experiments, and candidly stated the mode in which they were conducted. Messrs. Bunnett and Co. have challenged inquiry, and will, I am sure, be much obliged to any gentleman who can detect, and in a *gentlemanly* manner point out, any fallacy into which they may have fallen.

The striking points of difference between their plan and several of a *similar character* that have preceded it, and which have, one after another, been abandoned—are very clearly defined. The manner, therefore, in which Mr. Wm. Pole has attempted to insinuate a want of originality, and otherwise to throw discredit upon Messrs. Bunnett and Co.'s legitimate exertions, is unbecoming and unjust.

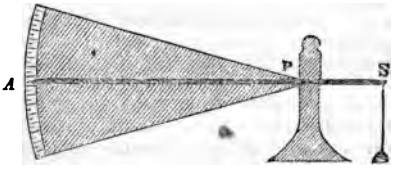
As a piece of wit, Mr. Pole's scurrilous effusion is miserably pointless, and though it may be adapted to the calibre of some of the low satirical publications of the day, *common sense* must tell him it is not calculated to assist the cause of science or of truth. Neither is it such communications as this, that have raised —or will ever sustain—the high and daily increasing reputation of the *Mechanics' Magazine*.

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, August 17, 1839.

PULSE INDICATOR.



Sir,—I herewith forward for your inspection a rough sketch of a little instrument that I contrived a few months since for making observations upon the pulse.

Not being strictly a medical man, I am unable to decide as to whether it may be usefully or beneficially employed; I have therefore taken the liberty of submitting it to the judgment of your readers.

The instrument sketched above is for the purpose of determining the action of the pulse with great accuracy, for I regard the pulse as the great index of vitality, and if its action could be more accurately registered it would be found to rise and fall with the smallest variations of the constitution.

A is a fine needle or metallic index working upon the pivot P, and bent downwards at S terminated by a little silver knob, B, whilst the graduated arc is for the purpose of measuring the motion of the instrument.

It is not very likely that this or any other instrument will supplant the present very convenient method of determining the number of beats per minute,* although this instrument might be employed for that purpose; it is for determining irregular and diseased pulsation that I deem this instrument will be found serviceable; for this purpose some spot must be selected where the action is strong and perceptible; if the patient be in a recumbent position the temporal artery would be a suitable spot; now if the instrument be put to stand near to the spot, and the knob B be brought directly over and upon the centre of motion, its action will be registered and multiplied by the longer arm A, and its irregularity would be denoted by the number of degrees, minutes and seconds passed over by the index in each succeeding pulsation. The spot that I have generally selected, for making observations upon myself, is a very conspicuous, arterial action situated midway betwixt the thumb and forefinger; the pulsation here is so strong that I can easily count its beats by sight alone at a distance of 3 feet.

Lastly, its most important application will, I think, be in determining some peculiar and silent changes going on in the constitution. For instance, I find upon a careful examination of my patient that his pulse averages 68 beats per minute, and the index passes over 5° 13″ 50‴; some three months, hence I again apply the instrument, and find, that although the pulsation remains the same in number, *id est*, 68 beats per minute, yet the index never registers more than 4° 45″.—Query,

The cause of this loss and the constitutional symptoms (as they must be) denoted thereby.

If this paper be deemed worthy of notice I shall feel gratified by its insertion.

I am, Sir
Your obedient servant,
CLIO.

* *By feeling or touch.*

THE "GREAT WESTERN" AND "BRITISH QUEEN."

Sir,—The termination of the late steam race across the Atlantic in favour of the *Great Western*, seems to have been precisely in the teeth of the anticipations of the knowing ones, both on this and the other side of the water. It appears strange that those who betted with so much rash confidence on the *British Queen*, should have totally overlooked the most material difference in the chances of the two vessels,—the fact that the *Queen* was indebted to Scottish engineers for her machinery! A great authority some time ago placed on record his opinion in your pages, that from her superior size, the *British Queen* would probably sail "*much* faster" than the *Great Western*. The same circumstance, coupled with her being "spick and span new," seems to have had the greatest influence in inducing brother Jonathan to back the wrong horse. It actually appears that at New York they made so sure of the *Queen* being first at the post, that very few letters were sent by her rival, the consequence of which, of course was, that the correspondents of the *Queen's* admirers were all "a day after the fair." What a pity these gentlemen did not bear in mind that 'every bean has its black," and that they did not, (after duly calculating the advantages the *Queen* possessed in her large size and complete novelty), give proper consideration to the far more important point against her—the circumstance that her engines were put in at Glasgow, while those of the *Great Western* were the *chefs-d'œuvre* of Maudslay and Field, *of London*.

It is not likely now, that either merchants or passengers will again overlook the disparity and its causes. Owing to both vessels starting at the same time, there happens luckily to be no excuse on the score of difference of wind and

weather; and the best of it is that the Company to whom the slow ship belongs, will stand but a small chance of retrieving their lost honours, having had *the prudence* already to send their second vessel to the North for her machinery, whence she will probably return early in the summer of 1841!

There is yet another circumstance which betrays the great inferiority of the *Queen's* machinery. She was left in the lurch, notwithstanding her being provided with Mr. Samuel Hall's patent condensers, which that gentleman (*Mech. Mag.* vol. xxxi. p. 252), "contended, without fear of contradiction, produced a great comparative increase of power beyond what they (the engines) would have had with injection condensers." From this we may safely take it for granted, that had not the *Queen* been assisted by Mr. H.'s valuable invention, she would hardly have reached England by this time. The inference is plain; her engines must be sorry things, indeed, when, with all the advantages the "patent" method gave them, they were actually beaten by those of the *Great Western*, furnished (*mirabile dictu*) with nothing but "injection condensers!!" All this is passing strange!

I remain, Sir,
Very respectfully yours,
OBSERVATOR.

August 19, 1839.

P.S. "A Constant Reader" will be worthy of notice when he produces at least one solitary fact to confirm his assertion as to the falsehood of the Government Commissioners' Report on the safety of London-made boilers. It is to be hoped that he is not a canny Scot himself; he would bring disgrace on the nation by the glaring want of a logical mind shown in his first asserting the superiority of Scotch engineers, and then telling the plain reason why they employ *neither good materials nor good workmanship!*

[After all the *British Queen* may justly boast of being, in two respects, wholly unrivalled. First, she is the largest steam-vessel in the world; and, second, she made the voyage from England to the United States, *and back*, in less time (thirty-two days and a half) than it was ever before accomplished.—ED. M. M.]

STEAM-BOILER EXPLOSIONS.

Sir,—If you think that the insertion of the enclosed letter, addressed to the Parliamentary Trustees on the river Clyde, would be likely to contribute in any measure to promote the interest of science, so far as that has a relation to the best means of preserving human life, your doing so at your earliest convenience, will much oblige,

Sir, your obedient servant,
J. M. GARDNER.

Nelson-street, Glasgow, July 16, 1839.

To the Parliamentary Trustees on the River Clyde.

Gentlemen,—In the *Glasgow Herald* of this morning, I observe an account of another steam-boat disaster, by explosion of her boiler, having occurred yesterday, at Renfrew Ferry, occasioning loss of life, &c.

Four years have nearly elapsed since you offered a reward or premium of one hundred guineas, and one hundred pounds for the *best plan* of preventing accidents of this nature. You received about 70 plans, accompanied with models, *one* of which must have been the *best plan*, and, of course, entitled the genius who produced it, to the offered premium. Perhaps he is too poor to prosecute you for payment; but certainly, in this case, "the labourer is worthy of his hire." I presume that the premiums would not have been drawn from your individual pockets; and, of course, non-payment may be considered in the light of an omission; but, as the Westminster divines say, "some sins, in themselves, and by reason of several aggravations, are more heinous than others."

I am still a claimant for the offered premium. You allowed from 14th September, till 10th October, 1835, a period of twenty-three working days, for the production of plans and competition. My plan was lodged within the given time, and although, since that time, engineers have attempted to alter, modify, and improve it, I have data sufficient to prove its originality.

You gave no guarantee for the payment of your premium; but I think I could safely pledge that of the whole sailing population of the United Kingdom for the payment of

One Hundred Guineas Premium,

for a better plan of preventing steam-boat accidents, occasioned by explosion, than the following, viz.:—Alter the present fitting up or construction of the machinery, so as to allow the engine to keep at work from the

commencement till the termination of the voyage. At every temporary stoppage, let the paddles be thrown out of gear in sufficient time to allow the vessel to come to a stand, for the ingress or egress of passengers—the engine still in motion, exerting its usual quantity of force against a resistance equivalent to its usual propelling power.

The turning of a lever only is required, in stopping and setting on, while the engine works on uniformly and continuously.

Rationale.—Explosions, in almost every instance, take place either during a stoppage or immediately on setting out.

Stationary boilers on land, seldom burst—those used in crossing the Atlantic have never yet burst. The steam-engine is now almost as perfect as human ingenuity can make it; but it is not a thinking agent—the mind of man must be employed in its construction and in directing its operations; and, from all I have seen, it appears to me obvious, that it is the sudden checking and sudden starting of steam-boat engines, which has been the cause of accidents by the explosion of boilers.

I am, gentlemen,

Yours very respectfully,

J. M. GARDNER.

Glasgow, July 12, 1839.

We perceive from a letter in the *Glasgow Chronicle*, which we also subjoin, that another esteemed correspondent of ours, Mr. D. Landale, has had equally strong reason to complain of the Clyde Parliamentary Trustees.

To the Editor of the Glasgow Chronicle.

Sir,—My attention was directed to an advertisement in your paper, some four years ago, emanating from the river Clyde Trustees, offering a reward of £100 for the best method of preventing steam-boat boiler explosions. I was induced, I believe along with about 70 others, to send in a plan, none of which, as far as I can learn, have ever been published, or have obtained the promised reward.

As it is understood that your columns are ever open to the exposure of abuses, I take the liberty of giving you an instance of the manifest injustice and bad faith which these trustees have been guilty of, in drawing upon the time and talents of so many individuals, and then burying their plans for so long a period, while others step in, and take the merit of what would not have belonged to *them had the trustees* fulfilled their obligations.

I have just read the parliamentary report and inquiry regarding steam-boat accidents, and at page 95, find that John Scott Russell, Esq., of Edinburgh, has there brought forward the very same plan which I submitted to the trustees nearly four years ago, namely the application of Saverg's steam-pump to keep the boiler full during all temporary stoppages, and derangement of the feeding apparatus, while the steam is up, thus giving a power always at command, at the proper time, to avoid that most fruitful source of explosions, want of water in the boilers, arising either from neglect, choking of the feed pumps, or the rapid evaporation of water that is going on during temporary stoppages. After having given the means of curing this evil, (which the late parliamentary inquiry has shown to be the most frequent cause of marine boiler explosion), I then described an arrangement of water and steam pressure gauges for the peculiar use of passengers, and showing on an index, in the clearest manner, that "he who runs might read," the state of the water in the boilers, and the pressure of the steam, with a notice desiring passengers to inform the captain should the index point beyond the "licensed pressure" mark, or the water index fall to the point marked "dangerous." Mr. Russell, amongst other valuable suggestions, has described in almost the same language both these passenger gauges, and my plan of filling the boilers during temporary stoppages, or derangement of the feeding apparatus.

Now, Sir, if there lie any merit in these arrangements, I have been most unjustly deprived of it by your river trustees, who have kept up my paper since December, 1835, while Mr. Russell's communication is dated 7th February, 1839. Had this reward not been offered, many of the plans, and mine among the rest, would have ere now been submitted to other quarters competent to judge and pronounce on their merits, and the priority of those worth attention would have been properly established.

I trust you will give insertion to these remarks, in the hope that they may meet the eye of the accused. If they cannot otherwise be induced to settle this matter, or publish the plans, it may be worth while to call a meeting of all the competitors to take into consideration the best means of prosecuting the river trustees.

I am, Sir,

Your most obedient servant,

D. LANGDALE.

Wemyss-cottage, Fifeshire,
August 5, 1839.

PROGRESS OF IRON SHIPPING.

While at Broomielaw the other day, the writer by the merest accident stepped on board a splendid new steamer, which has been christened the "*Royal George*," and is destined to act as consort to the "*Royal Sovereign*," at present one of the swiftest boats afloat on the station, stretching between the Clyde and Mersey. In the first instance he observed a painted board debarring admission, and was about to retrace his steps, when he discovered an old acquaintance, from whom he received a hearty welcome, in the person of Mr. M'Gregor, of the well-known firm of Todd and M'Gregor, engineers, Clyde Foundry, Glasgow. With this gentleman he had a long and interesting conversation respecting the comparative merits of iron and wooden steamers, a condensed outline or synopsis of which he will endeavour to give in what follows. The *Royal George* has been for some time afloat, and as her engine and other gearing are well nigh complete, she will leave the Broomielaw on an experimental trip in a week or so from the present date. Her length of deck is as near as may be 200 feet, and forms as beautiful a promenade as can be well imagined; burthen per register, including the space occupied by machinery, 300 tons, but in reality, nearly 700; engine power, according to the usual calculation, equal to the muscular strength of 250 horses. At present she draws scrimply *five*, and when loaded with 100 tons, her draught will not exceed seven feet of water. With the exception of the deck, bulwarks, paddle-boxes, rosewood linings of the principal cabin, &c., the entire framework of the beautiful ship described is composed of sheet-iron, three-eighths of an inch in thickness, and strongly riveted inside by bars or fastenings, which takes the form diagonal, the strongest of all. With a view to safety in the case of a sunken rock or lee shore, the extreme length from stem to stern is divided into five compartments, and the largest is not so much the hold, which can be dealt with as is deemed most expedient, as the gap filled with a double engine, furnaces, cylinders, and other appurtenances that manufacture the propelling power. Should a hole, therefore, be stove into a vessel's sides by collision with a rock or any other antagonist body, water can only rush into one compartment, to the extent of a foot, or possibly less, and so long as the others remain perfectly dry, sufficient buoyancy remains behind to enable the crew to apply the pump and repair the leak. The *Royal George* is the fifteenth iron steamer which Messrs. Todd and M'Gregor have *now built*, and their joint opinion decidedly is, that what are called wooden walls for navy purposes, will soon be at a discount, and iron ones at a premium. Between the cost of the one material and the other the difference is trifling, and the great advantage of iron is, that it lessens very considerably the draught of water—a recommendation, it may be added, beyond price in river navigation. Of this a remarkable instance occurred in the beginning of last week. The *Royal Sovereign*, as trim an iron "*Liner*" to Liverpool as eye ever looked on, sailed from that port on Monday the 22nd current, and arrived at the Broomielaw on Tuesday at 4 P.M., unshipped a large cargo, and took on board a second, with which she sailed the same evening; while the *Acteon*, a superb wooden steamer, which, according to report, was built and fitted up at an expense not much under 38,000*l.* sterling, was forced to remain at Greenock a whole tide for want of water. A notion has got abroad that iron steam boats are better adapted for rivers than the open sea; but this allegation is distinctly disproved by the experience of the "*Liner*" just alluded to. But it would be easy to multiply facts of a similar character; but a short time has elapsed since the Clyde Foundry engineers received an order for an iron sail ship of 500 tons burthen, destined for the American trade, and which a year or two hence will be seen careering in the wake of the *British Queen*, and the other great arches that span so beneficially the waters of the mighty Atlantic. In 1835 Messrs. Todd and M'Gregor built for a Waterford Company, who have steamers of different materials afloat, that ply regularly between Ireland and Liverpool, an iron boat; and during the four years that have intervened, the said craft has neither required nor received the slightest repair, while the whole of her consorts have been repeatedly caulked, and otherwise refitted, at an expense varying from 400*l.* to 500*l.* annually. This is another decided recommendation, which alone ranks second to lightness of draught, and how long an iron ship, with fair play, will last, is a problem, as yet undecided, and which possibly enough may not be solved for the next twenty or thirty years. The oil and grease which are so plentifully used in the engine-house below, diffuse a moistening influence which extends in some way to every part of the ship, and the balance of opinion, as to naval tear and wear, so far as experience has yet gone, is in favour of iron, and against wood, almost in the ratio of *three* to *one*.—*Dumfries Courier*.

On Friday last (9th August) one of the most handsome steam vessels of her size

ever built was launched from Mr. Borrie's slip adjoining his foundry. Considering that this is the first vessel of the kind constructed by Mr. Borrie, her mould and appearance bear unequivocal testimony to his scientific skill. She glided into the water amid the cheers of a large concourse of spectators. The following are the dimensions of this vessel:—Length of keel, 116 feet; length on deck, 130 feet; breadth within the paddle-boxes, 21 feet; breadth over all, 37 feet; depth of hold, 9 feet; measurement, 300 tons; draught of water when launched, 15 inches. Her calculated draught, when her engines, boilers, compliment of passengers, &c., are on board, is 30 inches; but it is expected that it will not exceed 28 inches. This is, we believe, the lightest draught of water ever attained by any vessel of her size in Great Britain. She will be propelled by two engines of thirty-five horse power each. The engines have expansion valves attached for diminishing the consumption of steam in the cylinders; and the boilers combine two arrangements in their construction, the one calculated to consume the smoke, and the other to ensure a more rapid generation of steam than any marine boilers hitherto in use. The symmetry of this vessel is greatly admired and seems to be as near perfection as can be attained. She must be a very fast smooth-water sailer, for which alone she is adapted. Altogether the vessel is a new laurel to Mr. Borrie's increasing reputation as an engineer.—*Dundee Chronicle.*

On Monday (12th August) a handsome iron sloop, built by Messrs. James and Charles Carmichael, was launched from their building-yard in the Iron Works, Sea Braes. She is named the *Tinker*, and measures sixty tons. She appears to be an excellent vessel; and all present at the launch admired her buoyant appearance in the water. This is the first iron sailing vessel which has been built at this port; but it is probable that the trade of building iron vessels to be propelled by sails, as well as by steam, will speedily increase, and be carried on to a great extent very soon. In the yard from which the *Tinker* was launched there is the framework of an iron steamer of 200 tons, which, we understand, is to be employed on the Mid-Lothian and Fife ferries. Although Messrs. Carmichael have not prosecuted the construction of marine engines to the same extent as some others, and particularly the modern nabobs of the Clyde, yet they were prior to every one of them in point of time; and what is better, they attained at once to *a degree of excellence in the construction of their marine engines, and of certainty and prevision in the working of them*, which, if it has yet been equalled, has never certainly, and probably never will be, surpassed. They could not only do well what others had done, but, when improvements to suit new circumstances were required, or serious difficulties to be overcome, they could *invent*. We well remember the burst of applause which broke forth on board of the "*Union*" twin-boat, nearly twenty years ago, when, by the simple turning of a handle, the vessel instantly began to move, and by the mere touch of this handle was made to go backwards or forwards. *Ex pede Herculem*, was the exclamation of a very influential individual, now no more: but the talent and genius which first gave a name to Dundee for engineering is still preserved to it; and we feel very confident that the comfort and rapidity of a passage across the Forth will be increased in scarcely a less degree when Messrs. Carmichael's vessel shall be placed on it, than the passage of the Tay was by the "*Union.*" It is pleasing to witness the enterprising spirit of these highly respectable individuals, and their competitor in business, Mr. Borrie, in this new field of exertion; and to reflect that there is every reason to believe the encouragement they have and are likely to receive, will stimulate them to perseverance in a branch of business in which they have already made so great progress.—*Ibid.*

ON THE COLOURS OF STEAM AND OF THE ATMOSPHERE. BY PROFESSOR FORBES.

[*From Abstract of two communications made to the Royal Society of Edinburgh, in Professor Jameson's Journal for July.*]

First Communication 21st Jan., 1839.—The author accidentally remarked, that the colour of the Sun seen through vapour issuing from the safety-valve of a locomotive engine is deep red, exactly similar to that which a column of smoke or smoked glass gives to it.

He next noticed that this colorific character of steam extended but a short way beyond the orifice, and that it gradually became more opake, and perfectly white like noon day clouds, both for transmitted and reflected light. At moderate thicknesses, in this state, its opacity is complete.

These observations were fully confirmed by direct experiments on high-pressure steam, made at Glasgow in December last. At the moment of issuing from the steam-cock, it is perfectly transparent and colourless; at some distance from the orifice it becomes transparent and orange-red; but, still farther off, it is white, and merely translucent. These properties were traced

in steam from a pressure above that of the atmosphere of 55lb., down to an excess of only three or four; and as in all cases the redness of the transmitted light was more or less distinctly seen, (and an excess of 10 or 15lb. does as well as any higher pressure), it was concluded that the effect of partial condensation in producing the phenomenon, would be rendered visible in great thickness of vapour of the lowest tension.

The great anolagy of the colour of steam to that which the clouds assume at sunset, or distant lights in certain conditions of the atmosphere, lead the author to suggest this singular property of condensing vapour as the probable cause of those phenomena, of which no satisfactory explanation could be given whilst this fact remained unknown. The prognostics of weather derived from the colours of the sky also receive elucidation from the fact.

Judging from the similarity of colour of steam and that of nitrous acid gas, and the remarkable power of absorbing certain definite rays of the spectrum discovered in that gas by Sir David Brewster, the author thought it probable that similar lines might be discovered in the spectrum formed by light transmitted through steam, and that these might be found to coincide with the *atmospheric lines* of the spectrum noticed by the same philosopher. The experiment was made with great care, but the expected result has not been hitherto obtained. The general action of steam on the spectrum is to absorb the violet, blue, and yellow rays, finally, leaving only the red and orange, with an imperfect green.

Since a portion of watery vapour in a confined space, originally transparent and colourless, may become, by mere change of temperature, first deep orange-red and transparent, and finally white and semiopake, the author notices another analogy with the singular effect of temperature in deepening the colour of nitrous acid gas, and thinks that these facts may one day throw some farther light on the difficult subject of the mechanical constitution of vapours, and particularly of clouds.

Second Communication, 4th February.—The object of this paper was to develope an application of the fact communicated by the author on the 21st January. It was then remarked, that the discovery that steam in a certain stage of condensation is deeply red-coloured for transmitted light, seemed to offer a probable solution of a difficulty which has never yet been fairly met, namely, the red colour of clouds at sunset, and the redness of light transmitted through certain kinds of fogs.

A pretty full history of theories proposed to account for the colours of the atmosphere was first given; it was obtained in almost every case from an examination of the original authorities. These theories were reduced under three general heads, exclusively of that of Göthe, and of most writers before Newton, that the blue colour of the sky results from a mixture of light and shade; and that of Muncke, that that colour is merely *subjective*, or arises from an ocular deception. The remaining theories are:—

(1.) That the colour of the sky is that transmitted by pure air, and that all the tints it displays are modifications of the reflected and transmitted colours. This is more or less completely the opinion of Mariotte, Bouguer, Euler, Leslie, and Brandes.

(2.) That the colours of the sky are explicable by floating vapours acting as thin plates do, in reflecting and transmitting complementary colours. This is the theory of Newton and most of his immediate followers, and more lately of Nobili.

(3.) On the principle of opalescence and of specific absorption, depending on the nature and unknown constitution of floating particles. This head is intended to embrace the various opinions of Melvill, Delaval, Count Maistre, and Sir D. Brewster.

To the last named philosopher, however, the merit is due of having conspicuously turned attention to the important, comp ex, and hitherto unexplained phenomena of absorption, which he has proved to be totally inconsistent with Newton's theory of the colours of Nature, (considered as those of thin plates); and he has further demonstrated the inapplicability of it in the case of the colours of the atmosphere, by showing that their constitution is wholly distinct from that which any modification of Newton's theory would assign, by a series of experiments of which as yet the results only are announced.

Since, then, the constitution of the atmospheric colours analyzed by the prism resembles that produced by absorption, the question is, To what medium are we to refer that absorptive action? Evidently not to pure air, since a distant light is red in a fog, and in clear weather white, or nearly so. The author is disposed to attribute the effect to the presence of vapour in the very act of condensation. This intermediate or colorific stage occurs between the colourless and transparent form of steam wholly uncondensed, and that which may be termed the state of proximate condensation in which it is seen to issue from the spout of a tea-

kettle, when it is likewise colourless, but semiopake. During the transition, it was shown in the former paper that steam becomes intensely red, and remains transparent. The absorptive action resembles then, so far, that of the atmosphere observed under certain meteorological conditions; the dark lines and bands noticed by Sir David Brewster in the atmospheric spectra have not been discovered, and so far the analogy is as yet imperfect.*

In applying this theory to the colours of sunset in particular, the author quotes many acknowledged facts to prove that the redness of the sky is developed precisely in proportion to the probable existence of vapour in that critical stage of condensation which should render it colorific. And he applies the same reasoning to account for the prognostics of weather, drawn from the redness of the evening and morning sky.

BEST FORM FOR STEAM VESSELS.

The United Service Journal has lately contained some interesting papers, by Lieut. Wall, R. N., "on the construction, proportions, and power best adapted to sea-going steam-vessels." In his last he gives the following as the result of a careful examination of the experiments of Col. Beaufoy, Sir John Robinson, and others:—

"First, that the resistance of a body passing through a fluid is as the square of the velocity.

"Secondly, that an increased facility in passing through a fluid is imparted to a body by an increase of its length.

"Thirdly, the resistances of small superfices are nearly as the surfaces, but the resistence is greater than a proportional increase of surface, and that this deviation from theory increases with the extent of surface.

"Fourthly, that the resistance to the passage of bodies through the water is proportional to the angle at the head, other proportions being alike.

"Fifthly, that the resistances do not vary in the duplicate ratio of the angle of incidence.

Sixthly, that for the higher rate of velocities, the flatter a vessel is built in the floor the better, *when intended to be propelled by machinery.*"

From which we infer—first, that as double power will not propel the same body at double the speed, the larger steam-vessels are built the better; secondly, that the length of a vessel in proportion to her breadth may be increased beneficially (for speed) until the lateral resistance shall equal the increased momentum obtained by additional length (which is at about eight times the breadth)—that the extreme breadth ought to be exactly amidships—that the form of the bottom, *below the water-line*, ought to be as flat as possible for about three-fifths of the length and from thence to draw in forward and aft for the entrance and run—the bow to be as sharp as would be consistent with safety in a sea-way, but the run not to be *too fine*.

It is also recommended that the counters and harpings be kept full, the stern-post nearly upright, and the stern formed on the circular construction. In consequence of the shallowness of the vessel, it would be necessary that the quarter-deck and forecastle be covered in, by which much room would be obtained below; and the deck of the latter, being bevelled and carried well aft, would serve to turn off any sea which might be shipped in steaming head-to-wind. It would also be advisable that the bulkhead of the quarter-deck cabin be given a semicircular form, having ports cut at its junction with the vessel's side, for the escape of the wind.

WORKING STEAM VESSELS WITH THREE ENGINES.

In the papers of Lieut. Wall, quoted in the preceding notice, there is a proposition for making large steamers with three engines, which seems well deserving of attention.

"The writer is fully aware of the objections to be urged against the adoption of three engines; but, having given the subject his best attention, is of opinion the advantages of three engines predominate greatly over those to be obtained by the use of two. In the first place, with two cylinders only, it would be hardly possible to adopt the principle of working the steam expansively with any benefit, because the variation of power caused by allowing the steam to expand after entering the cylinder would require a corresponding variation in the resistance to be overcome; but, as that cannot be obtained, in the propulsion of a vessel, an un-

* Some plausible reasons are assigned why these bands should not have appeared in the experiment as it was made, when steam in every stage of condensation must necessarily have been present; nor does it seem easy to devise a form of experiment *free from this objection*. A very important observation would be to examine the spectrum produced *by a distant artificial light seen through a red fog.*

equal and jerking motion would be the result of working expansively with two cylinders only; whereas this inequality of impulse would be greatly reduced by the adoption of three, one of which would always be in full operation. Again, in the event of an accident occurring to one of two cylinders, the power of rotation would be almost destroyed; while, with three engines on board a vessel, one of them might be stopped, either to allow the parts to cool, or for the purpose of repair; and, lastly, (a point not hitherto considered) the density and elasticity of the vapour would be so much reduced by the operation of the principle of expansion as greatly to increase the facility of its condensation. These advantages, it is supposed, would more than counterbalance the increased expense, weight and friction of the third cylinder."

NOTICE ON THE ALCOHOLIC STRENGTH OF WINES. BY DR. CHRISTISON.

[*From the Edinburgh New Philosophical Journal for July.*]

Various accounts have been given of the alcoholic strength of wines by Mr. Brande, Julia-Fontenelle, and others. The author has been engaged for some time in experiments for determining the proportion of alcohol contained in various wines of commerce, and also the circumstances which occasion a variety in this respsct. The present paper is an interim notice of the results.

The method of analysis consisted in the mode by distillation, which was applied with such contrivances for accuracy that nearly the whole spirit and water were distilled over without a trace of empyreuma, and without the loss of more than between 2 and 6 grains in 2,000. From the quantity and density of the spirit, the *weight* of absolute alcohol of the density 793.9, as well as the *volume* of proof spirit of the density 920, was calculated from the tables of Richter founded on those of Gilpin.

The author has been led to the general conclusion that the alcoholic strength of many wines has been overrated by some experimentalists, and gives the following table as the result of the investigations he has hitherto conducted. The first column gives the per-centage of absolute alcohol by weight in the wine, the second the per-centage of proof spirit by volume.

	Alc. p. c. by weight.	P. Sp. p. c. by volume.
Port—Weakest	14.97	30.56
Mean of 7 wines	16.20	33.91
Strongest	17.10	37.27
White Port	14.97	31.31
Sherry—Weakest	13.98	30.84
Mean of 13 wines, excluding those very long kept in cask	15.37	33.59
Sherry—Strongest	16.17	35.12
Mean of 9 wines very long kept in cask in the East Indies	14.72	32.30
Madre da Xeres	16.90	37.06
Madeira, all long in cask in East Indies — Strongest	14.09	30.80
Madeira, all long in cask in East Indies — Weakest	16.90	36.81
Teneriffe, long in cask at Calcutta	13.84	30.21
Cercial	15.45	33.65
Dry Lisbon	16.14	34.71
Shiraz	12.95	28.30
Amontillado	12.63	27.60
Claret, a first growth of 1811	7.72	16.95
Chateau-Latour, first growth 1825	7.78	17.06
Rosan, second growth 1825	7.61	16.74
Ordinary Claret, a superior "vin ordinaire,"	8.99	18.96
Rives Altes	9.31	22.35
Malmsey	12.86	28.37
Rudesheimer, superior quality	8.40	18.44
Rudesheimer, inferior quality	6.90	15.19
Hambacher, superior quality	7.35	16.15
Giles' Edinburgh Ale, before bottling	5.70	12.60
The same Ale, two years in bottle	6.06	13.40
Superior London Porter, four months bottled	5.36	11.91

In addition to certain obvious general conclusions which may be drawn from this table, the author stated, as the result of [illegible] experiments, that the alcoholic strength

various samples of the same kind bears no relation whatever to their commercial value, and is often very different from what would be indicated by the taste even of an experienced wine-taster.

Some observations were next made on the effect produced on the alcoholic strength of wines by certain modes of keeping or ripening them, more especially by the method employed in the case of sherry, madeira, and such other wines, which consists of slow evaporation for a series of years through the cask, above all, in hot climates. The researches made by the author on this head are not yet complete; but he is inclined to infer, from the experiments already made, that, for a moderate term of years, the proportion of alcohol increases in the wine, but afterwards, on the contrary, diminishes; and that the period when the wine begins to lose in alcoholic strength is probably that at which it ceases to improve in flavour. The increase which takes place at first in the alcohol of wine undergoing evaporation through the cask, appeared at first view parallel to the fact generally admitted on the authority of Söemering, that spirit becomes stronger stronger when confined in bladder, or in a vessel covered with bladder, in consequence of the water passing out by elective exosmose.

The author, however, on repeating the experiments of Söemering, as related by various writers (for he could not obtain access to the original account of them), was unable, by any variation of the process he could devise, to obtain the results indicated by the German anatomist. Constantly the spirit, whatsoever its strength, whether proof spirit or rectified spirit, became weaker. It was observed at the same time, that, if the bladder containing spirit was enclosed in a confined space with quicklime, the spirit slowly became absolute alcohol of the density 796, in consequence of a permanent atmosphere of alcohol being speedily formed, while the watery atmosphere was absorbed by the quicklime as fast as it was produced. Subsequently it was proved that the bladder was not essential to the process: for an open cup of rectified spirit, inclosed in a confined space with quicklime, to absorb the water which arose from the spirit, became in two months absolute alcohol of the density 796. Professor Graham of London some time ago proved the analogous fact, that spirit might be thus rendered pure alcohol in the air-pump vacuum. A vacuum, however, is, upon principle, as well as in fact, not necessary for the process; it merely accelerates it. The new method is obviously applicable on the great scale for obtaining absolute alcohol, wherever time may be allowed.

MECHANICS' INSTITUTIONS.

The Committee of the Society for the Diffusion of Useful Knowledge, lately addressed a circular, of which the following is a copy, to the Secretaries of the different Mechanics' Institutions in and around the metropolis:—

"59, Lincoln's Inn Fields, August 2, 1839.

"Sir,—It is the wish of the Committee of the Society for Diffusion of Useful Knowledge, to establish a correspondence among the various Mechanics' Institutions in England, and between them and this Society; so that neighbouring institutions, by dividing the travelling expenses of lecturers among them, may diminish the cost of each course of lectures; that one set of apparatus, or collection of models or of specimens of natural history, or even one set of books, may serve for many institutions; and that local collections, and duplicates from libraries and museums, may be interchanged all over the country.

"The Committee likewise desire, by an annual report, and by correspondence and interchange of suggestions and advice, to make the experience of one institution serve as a guide to others; and they hope, by degrees, to be able to assist in supplying the wants of the various institutions, whether these relate to teachers, to books, or to apparatus.

"With this view, they are desirous of receiving from all Mechanics' Institutions and similar bodies, annually, in the month of June, such a report of their proceedings, as will enable the Committee to give, annually, a view of the progress of adult education in Great Britain; and they entertain no doubt that great benefit will result from their labours, if they are seconded by the cordial assistance of the several institutions throughout the kingdom.

"The Committee are of opinion, that such a correspondence among the Societies in London and its neighbourhood, would be very advantageous, not only directly to these institutions, but as an example and incitement to those in the country; and they are desirous that one or two members of your Committee, should do them the favour to meet me and some of my colleagues here on Wednesday next, at four o'clock, for the purpose of conferring with us upon the expediency and the means of establishing such a correspondence.

"I have the honour to be, Sir,
"Your very humble servant,
(Signed) "BROUGHAM, Chairman."

A number of gentlemen interested in the success of those institutions assembled accordingly at the Society's chambers at the time proposed, when Lord Brougham explained

more at large the advantages of the system of co-operation proposed by the circular, and resolutions in favour of it were unanimously adopted.

PATENT LAW CASES.

Roll's Court, August 3.—"London Caoutchouc Company *v.* Bedells and Biggs and others."—It appeared from the statement of Mr. Pemberton, who was counsel for the plaintiffs, that the company possessed a patent for a mode of application of India rubber in the manufacturing of a certain description of cloth, &c., and the specification of the patent declared it to consist of three objects. The defendant Bedells had infringed the third object, which was the introduction of a spiral thread round the strands of Indian rubber used in weaving elastic webs.

Mr. Richards, who appeared for Mr. Bedells, said, that he had no objection to offer to the order of the Court, restraining him from using the spiral thread; he had not known that his use of it infringed the plaintiffs' patent until he received a notice to that effect, and he had immediately, on receiving such notice from the secretary of the Caoutchouc Company, abstained from using it, as it was unimportant to him.

The question as regarded the Messrs. Biggs was different, inasmuch as it appeared that they were charged with having attached bands of India rubber web to the gloves manufactured by them, in which band was inserted strand of India rubber wound round by a spiral thread, which was a violation of the third object of the plaintiffs' patent, and that they had also violated the first object of the plaintiffs' patent, which was for an improved mode of introducing into the knitted fabric of gloves and other articles of hosiery strands of India rubber, so as to form an elastic margin.

Mr. Richards, who was also counsel for the Messrs. Biggs, stated, that as to the third object, the use of the spiral thread, it was a matter of indifference to them whether the web they used contained it or not; indeed, they should prefer it without; but as to that portion of the application for the injunction which sought to restrain the defendants from manufacturing gloves according to the patent assigned to them (Messrs. Biggs), they would resist that. They insisted on their right to attach India rubber elastic web to gloves in the mode practised by them, so long as that web did not contain the spiral thread.

After some communications between the counsel and the attornies for all parties, it was arranged that an order should be made, that an injunction be issued against defendants restraining them from using bands to their gloves containing the strands of India rubber having the spiral thread; and pay 10*l.* to the company as the computed amount of profit on the web which had been attached to the gloves they had sold, and to those on hand. The company on the other hand, admitting the right of Messrs. Biggs to attach the web to their gloves, and manufacturing them as they had done, but without the spiral thread.

Devon Assizes, July 29.—"Bickford and others *v.* Skewes, the Younger."—This was an action for the infringement of the plaintiff's sole right to the manufacture and sale of the "Miners' Patent Safety Fuse," the question being of considerable importance to the parties concerned.

Mr. Erle, Mr. Crowder, and Mr. Smith, were for the plaintiffs; Mr. Sergeant Bompas and Mr. Butt, for the defendant.

The safety fuse is a kind of small rope, spun with a layer of gunpowder running through the centre, the outside being coated with pitch or tar, with whitening sprinkled over it to prevent its sticking to the hand. This fuze is used for blasting mines and rocks, and is a valuable invention, inasmuch as it obviates the dreadful accidents that frequently occurred by the old modes of blasting by the rush or quill. A beautiful executed model for manufacturing the fuse was placed on the table, from which the process was clearly explained to the Court and jury. It was contended, on the part of the plaintiff, that he was the original inventor, and his patent, taken out in 1831, was proved. Evidence was here given, that, in 1837, a woman, named Hosking, left the factory of Messrs. Bickford, and went into the employ of defendant, who erected a machine resembling the plaintiff's, and manufactured an article imitating their fuse, which article he sold to the injury of the plaintiff's rights; the plaintiff's witnesses also deposed that they had never seen a fuse in use like Mr. Bickford's, before he introduced it.

The defendant alleged that Mr. Bickford was not the original inventor, but that the safety fuse was in public use before he took out his patent, and that he had not infringed the patent, as neither the machine, the materials of the fuse, or the fuse itself, were properly described in the patent, as required by law. The main question appeared to be, as to the invention and prior use of the article; the defendant's counsel, in the course of the examination, agreeing to admit that he had infringed the patent, so far as the manufacturing and selling a similar article went.

A large number of witnesses were examin on both sides, but they did not bear ou

Cornish motto of "one and all," as they told different stories.

The case was adjourned at the rising of the Court, and proceeded with on Tuesday. The examination of the defendant's witnesses occupied the Court till two o'clock; and at four o'clock the jury returned their verdict for the plaintiff—Damages One Shilling.—*Mining Journal.*

NOTES AND NOTICES.

Animal Magnetism--A New Freak.—We have already published an account, on the faith of the Smyrna journals, of two extraordinary phenomena, which manifested themselves in two young Grecian females, without being able to state in what order of natural facts they ought to be classed. Here are some details:—When placed within three yards of each other, those young women impart to the intervening objects a rapid movement, which displaces them, whatever their weight, even though considerable, and hurries them violently from one to the other. These females arrived a few days ago in Marseilles, and were received into the house of an hon. merchant of their nation, who lent his saloon, on Wednesday, to try experiments, which we witnessed, in the company of several distinguished inhabitants of our city. Among them were Drs. Cauviere and Rousseau, M. Barthelemi, director of the Museum of Natural History; and M. Salze, Director of the Garden of Plants, and Professor of Natural History at the Royal College. The two young women, the youngest of whom is named Dhespinou, and the eldest Zambellou, were separated by a round table, made of walnut wood, and about six feet in diameter. We do not intend entering into a detailed account of the results of this experiment, we shall only affirm that the table, in our presence, and in that of the persons above mentioned, moved several times, of its own accord, as if it had been suddenly animated, from Zambellou towards Despinou. This, it appears, is invariably the case, and it at first induced the belief that there existed a magnetic fluid precipitating itself from one to the other—an hypothesis, however, which the experiments made in Smyrna, with so much care, by Dr. Galien Clado, did not confirm. Until we obtain some better explanation of those extraordinary facts, we shall confine ourselves to repeat what we have already stated—namely, that we saw several times that cumbersome table move of itself, and that the arrangement of the place, as well as the character of the person in whose house the experiment was made, precludes even the shadow of a suspicion of connivance or quackery.—*Semaphore de Marseilles.*

Cloth Making Without Spinning or Weaving.—Among the many extraordinary and truly wonderful inventions of the present times, is a machine for the making of broad or narrow woollen cloths without spinning or weaving, and, from our acquaintance with the staple manufacture of this district, after an inspection of patterns of this cloth, we should say there is every probability of this fabric superseding the usual mode of making cloth by spinning and weaving. The machines are patented in this and every other manufacturing nation. The inventor is an American, and appears to have a certain prospect of realising an ample fortune by the sale of his patent right. We understand patterns of this cloth, as well as a drawing of the machinery, have been shown to many of our principal merchants and manufacturers, none of whom have expressed a doubt but that the machinery appears capable of making low cloths which require a good substance. Should it succeed to any thing near the expectation of the patentees, its abridgment of labour, as well manual as by machinery, will be very great. We find that means are already taken to introduce this machine among our continental rivals; a company of eleven gentlemen in London have deposited five thousand pounds with the patentees, who have ordered a machine for them; when finished, they are to try it for one month, and if at the end of that time they think it will succeed, they are to pay twenty thousand pounds for the patent right in the kingdom of Belgium, and it will of course be worked there. We are therefore bound in duty to our country, and her manufacturing interests, to adopt such facilities as will prevent us failing into a position below our rivals in other countries. We are informed the necessary machinery for the production of this patent woollen felted cloth will be tried here in a week or two, under the superintendence of the inventor, by a cloth merchant who has an exclusive licence, but is about to associate with him twenty other respectable business men, for the purpose of sharing the expenses of giving the invention a fair trial. It is calculated that one set of machinery, not costing more than six hundred pounds, will be capable of producing six hundred yards of woollen cloth, 36 inches in width, per day of twelve hours.—*Leeds Mercury.*

Steam in America.—It is clear enough that steam is bringing on a new era. Now it is reported that we are to have a line of superb iron boats between Glasgow and New York, of a construction and power which it is confidently believed will accomplish the voyage in *ten days* regularly. Again, a New Orleans paper intimates that there is to be shortly a direct steam communication between that city and Liverpool, and that there is at this moment a steam ship on the stocks in the latter port, which will be launched in time to make her first voyage next fall. These are signs of the times. They indicate, as is intimated, a new era,—a complete commercial revolution, among other things, but much more of course. Look at the personal intercommunication between the continents, and consider the effect of *that* in all its bearings. Let it be understood, however, that is not the mere steam facilities of themselves that seem to aid locomotion among all classes; but the *spirit of steam*, so to speak, wakes up everything else. Those who cannot travel in a steam-boat must travel in some other way. Those who cannot cross the Atlantic, are yet bent upon locomotion. The world, in a word, is rubbing its eyes open. This whole continent, as I have before remarked, never presented (could one survey its vast surface) such a strange exciting spectacle of activity and agitation of body and mind. Nobody is content with the old rate or ratio of doing things. It would seem as if the very steam-boats themselves had put new courage on, and that they were multiplying their forces by almost supernatural means. You estimated the boats on Lake Erie last season at forty, whereas there are now seventy. The style in which those mighty inland seas are now hourly traversed by these floating palaces, is, as Crocket says, a "caution"—a caution for people to be prepared for all things, and to disbelieve nothing. The steamer *Cleveland* made the passage recently from Detroit to Buffalo (300 miles) with 100 passengers, in 21½ hours, and at something like this rate they are flying up and down the Mississippi. The "*William French*," says a New Orleans journal, "made her last trip from this city to Louisville and back, in *eleven days and twenty hours.*" I perceive that a voyage was lately made from the same port all the way up to Cincinnati, and back again, in sixteen days, or rather less.—*American Correspondent of the Athenæum.*

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

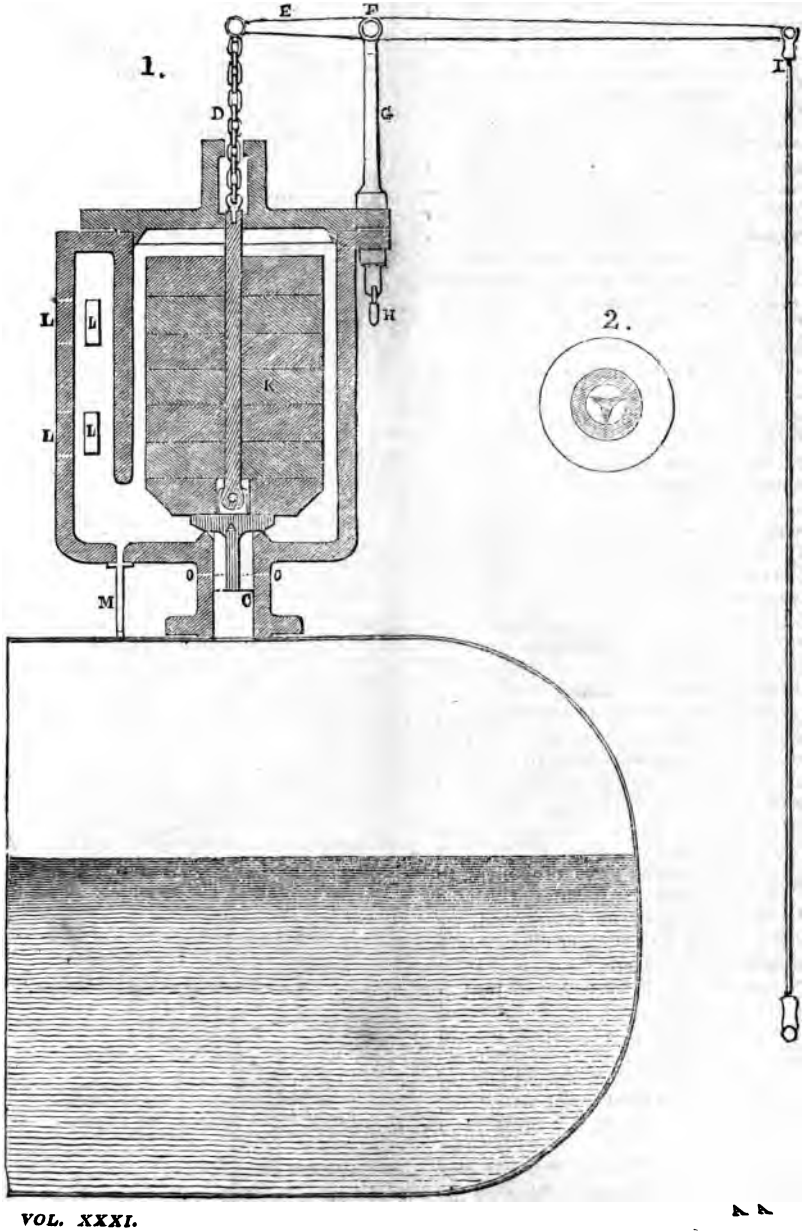
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 838.] SATURDAY, AUGUST 31, 1839. [Price 3*d.*

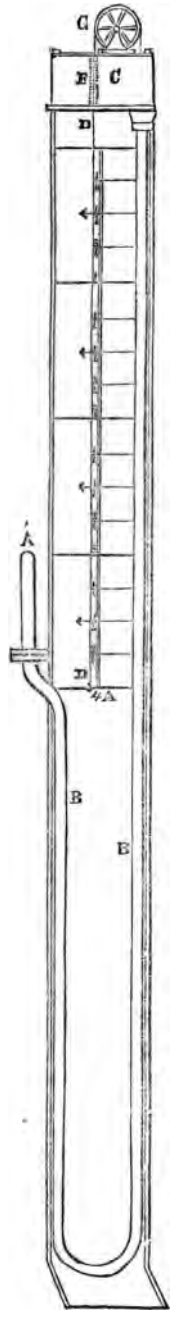
Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

BELGIAN GOVERNMENT STEAM SAFETY-VALVE.



BELGIAN STEAM SAFETY-VALVE AND PRESSURE GAUGE.

Fig. 3.



Averse as we have always expressed ourselves to be to the interference of the legislature with the operation of the machinery or manufactures of the country, and much as we have had to deplore the evil effects of existing restrictions—we cannot but regret that another session of parliament should have passed without the enactment of some measure calculated to prevent the recurrence of accidents such as are instanced in the report of Messrs. Parkes and Pringle. In all the continental nations, the working of steam-engines is subject to strict supervision and regulation. The government report referred to, and from which we lately extracted so largely, contains these regulations at length, as regards France, Belgium, Holland and America.

Now we would not for a moment be thought to recommend the adoption of restrictive rules similar to any of these; but we think that some general order, (of the nature mentioned by Messrs. Seaward in their letter to the Commissioners, for instance) must be acknowledged, on all hands, to be necessary for the safety of the public, and particularly of the engineers and firemen. Necessity compels the latter to risk their lives for their living, and it is incumbent upon us to use our humble efforts to produce such a state of things as will enable them to pursue their calling in safety.

A law has been promulgated in Belgium, of subsequent date to that published in the appendix to Messrs. Parkes and Pringle's report. It is dated the 24th of June last. Amongst other enactments, it determines the thickness of iron or copper which shall be used for various sizes of boilers, to be worked at certain pressures; the table by which this is to be determined, we shall, perhaps, take another opportunity of publishing. There is also a table which is directed to be followed in fixing the sizes of the aperture to be covered by the safety-valve, for boilers of certain sizes, and to be worked at certain pressures. The particular description of safety-valve to be used is also described, and figured. Every boiler must have *two valves; one of these* valves is to be *kept locked, and inaccessible* to any one *except the head of the* establishment to *which the engine belongs.* The weights

upon the valve are to be examined and placed by a public officer intrusted with the matter, and are not to be increased without his intervention, on any pretence whatever.

The following is a description of the valves prescribed to be used:—Fig. 1, on our front page is an elevation of the apparatus. A, is the copper-valve, having a triangular tail, and of a shape more clearly seen in fig. 2, which is a section through the line *o o*; the edges of which tail fit into a cylindrical seat as shown. D, a small chain, having one end attached to the stalk of the valve at B, and the other to a lever of the first order E, having its centre of rotation at F. G. is a pillar which supports the lever. K. are the weights of the valve corresponding to the maximum pressure of the steam. L, is the discharge-pipe with its openings. I, a cord or chain to the door of the furnace by which to raise the valve. M, pipe by which to discharge the water collecting by the condensation of the steam. H, is a lock, passing through one of the bolts of the cover, for the purpose of keeping the valve shut up.

It is further ordered by the law of June 24th, that the boilers of stationary engines shall be supplied with a pressure gauge of mercury acting in the open air. Boilers of locomotive or marine engines are to have pressure-gauges acting by compressed air, graduated so as to express the strength of the steam in the boiler. These gauges are to be so placed that the engineer or fireman attending the working of the boiler shall be able to observe the pressure of the steam with facility. There is hardly sufficient novelty in this Belgian government steam gauge to render a description and engraving necessary; but this notice might have been deemed incomplete without it.

Fig. 3, (on the opposite page) is the mercurial steam pressure gauge. A, is the pipe communicating with the gauge and the boiler. B, is a bent tube or inverted syphon in which mercury is elevated by the pressure of the steam. D, is a cord carrying at its extremity a needle to indicate the pressure of the steam upon a scale graduated in atmospheres. C, is a vessel to receive the mercury when it happens to overflow by reason of excessive pressure of steam. G, is a grooved pulley, *supporting* the cord D, which tra*verses the vessel C,* by the small tube F.

THE "BRITISH QUEEN" AND HER PERFORMANCES—THAMES AND CLYDE-BUILT STEAMERS.

Sir—On my return here after an absence of some weeks, my attention has been called to a letter from a person signing himself "Piston," published in your Magazine of 3rd inst., No. 834. I am not generally in the habit of noticing anonymous attacks, as your publication will testify, but there are several reasons for my making this case an exception to the general rule.

It is a very easy matter for an interested person to adopt a fictitious signature and to use intemperate language, but that is the sure way of putting sensible and respectable men upon their guard against exaggerated and false statements. "Piston" commences his attack upon me as follows:—"I should not have again adverted to the unlucky *British Queen* had there not recently appeared in your journal a bold inflated letter from Mr. Samuel Hall," now I beg to refer you to my letter to which he alludes, of 5th July last, and inserted in your Magazine 13th of that Month, No, 831, and I appeal to you and to your readers whether it contains any thing but a simple statement of facts; and whether the epithets "bold" and "inflated" are not unhandsomely and impertinently applied to it? I will not however be too severe upon poor "Piston," for although I must censure him for the intention with which his attack upon me was written, I sincerely thank him for its unintended results; he establishes facts respecting the importance of my condensers the benefit of which far outweighs all his short sighted and intended mischief. In the first place, although he "sneers" at my supplying by my condensers "pure distilled water" instead of salt or dirty water to the boilers, (he actually as is sometimes the case with an adverse witness,) inadvertently proves the fact. In the second place, he establishes the important circumstance of my obtaining by my condensers a vacuum that will support a column of 29⅝ inches to 29 inches of mercury, the latter being the lowest he mentions. What therefore is the conclusion we may draw, taking the above data for reasoning upon? I submit that as a matter of course the consequent advantages which I obtain by my con

densers and which I shall enumerate at the end of this letter will be obtained, and that such will be admitted to be the case, not only by uninterested and intelligent persons, but even by "Piston" himself, after the admissions which he has made.

I will now in return for the kind offices I have received from "Piston," oblige him by telling him what was the cause of the injury done to the boilers of the *British Queen*, and why Messrs. Rennie's workmen were sent on board that vessel while at Blackwall. With respect to the first matter, I will assert, (and that in a manner so positive) that "Piston" may possibly apply to his favourite words "bold and inflated," that had my condensers, which require no blowing out of the boilers, been *alone* applied to the engines of the *British Queen*, no such accident as the water getting too low in the boilers could have taken place, for (as I presume "Piston" must know) every gallon of water which is converted into steam, and in that state is sent out of the boilers, is by condensation reconverted into precisely the same quantity and returned into the boilers, whereby the water is constantly maintained within them at precisely a given height, without requiring any attention on the part of the engineers, as is constantly the case with injection engines. There are, however, injection condensers as well as my condensers on board the *British Queen*, and of course the former required blowing-out cocks to be put to the boilers. That the water was blown out of them too low by these cocks is quite certain; and that it was done by design and not by accident, all parties concerned were from circumstances perfectly convinced, and "Piston" is, I have no doubt, fully aware that this is not the first piece of wilful mischief that has been done to engines with my condensers.

With regard to my reason for sending to the Messrs. Rennie for workmen on board the *British Queen* (which seems to have caused "Piston" to feel sore,) I give it with pleasure; it was simply this, that I considered them to be men of probity and honour, free from duplicity, and gentlemen.

It is not for me to enter the lists of *disputants respecting* the comparative *merits of the engineers* in London and those in Scotland, but I do not think that I should act as a man of honour were I not to bear my testimony to the excellent workmanship of the engines of the *British Queen* and of the *India*, both of which are so unfairly attacked by "Piston." I frequently inspected both these pairs of engines during the time of their construction and can speak to the admirable accuracy and excellency of every part of their workmanship of which from 30 years' experience in engineering and machinery, I have the vanity to consider myself somewhat of a judge. I have been frequently through the principal marine engineering establishments in London, and have experienced great pleasure in examining the excellent workmanship produced by each manufacturer respectively; I have also been frequently at the establishments of Mr. Robert Napier at Glasgow, of Messrs. Scott, Sinclair and Co. of Greenock, and I may add, of Messrs. Caird and Co. of the latter place, and I should not do justice to those marine engine manufacturers, were I not to state my full conviction that their work is in all respects quite equal to any whatever, whether done in London or elsewhere.

I cannot conclude this letter without noticing the unhandsome attack (to use no stronger language) made by "Piston" on the Directors of the British and American Steam Navigation Company, and I have no hesitation in repeating what I have formerly stated, "That they will congratulate themselves in having exercised a sound discretion in availing themselves of apparatus, the sterling value of which has been fully proved by nearly six years of experience on board many of the largest class of steam vessels;" and I will add, that the Directors exercised also a discretion no less sound in employing so excellent a manufacturer to make the engines and the apparatus in question; for I am persuaded that every voyage which will in future be made by the *British Queen* will convince the Directors that Mr. Robert Napier has done them as ample justice as they could have obtained in the Thames; for among other things they and the public may rest perfectly easy and satisfied in their minds that *the frame-work of the* British Queen *will never break down and* require patching and holding *together by* wrought-iron straps.

Recapitulation of the advantages derived from my Condensers as above mentioned and alluded to.

1st. The supplying of pure distilled water, instead of salt or dirty water to the boilers.

2nd. The production of a superior and more steady vacuum.

3rd. A considerable saving of fuel owing to the boilers being in a clean state arising from them being supplied with pure distilled water, &c.

4th. A material increase of power, owing to the superior vacuum, the not having any injection-water to pump out the ample lubrication of the internal parts of the engine hereafter mentioned, and other causes.

5th. An ample lubrication of the internal parts of the engines owing to the oil which is put into the stuffing-boxes and cylinders not being on reaching the boilers blown out with the salt water as in injection-engines, but being returned mechanically along with the steam to the cylinders, &c.

6th. A greater increase in the durability of the boilers, which will endure many years longer than those applied to injection-engines, which is owing to the above-mentioned causes, viz., the supply of pure water, the ample lubrication of their insides, &c.

7th. The saving of the labour and loss of time required in the clearing of scale and earthy matter from boilers, which is incident to those of engines having injection condensers.

8th. Increased safety to the boilers and engines, the water in the former being constantly maintained at the proper height without any attention being required on the part of the engineer; thus obviating (particularly in marine engines) the risk in injection-engines on the one hand of their being burned, destroyed or burst by his allowing the water to become too low, or on the other hand, the danger arising from water passing with the steam into the cylinders, by allowing the boilers to become too full, whereby accidents to the engines of the most serious nature are frequently occasioned.

9th. The injury done to the air-pumps of injection-engines by water containing earthy and other extraneous matters is avoided, and as none but pure water *enters them from my* condensers, copper or gun-metal rods, buckets and linings become unnecessary, and the power is saved which is required to pump the injection-water out of a vacuum as already intimated.

10. The oil used for lubricating the valves, pistons, cylinders and air-pumps is not wasted, but as already stated, it enters the boilers along with the feed-water from the air-pumps, and is returned mechanically in minute particles (in commixture with the steam) to the engines, and is thus used over and over again, *ad infinitum*, in most abundantly effecting internal lubrication.

Besides the above it will be evident to any one on reflection, that many consequential practical advantages will also result from them to steam navigation.

I remain Sir, yours, respectfully,

SAMUEL HALL.

No. 18, King's Arms Yard, London, August 26, 1839.

THE "BRITISH QUEEN"—SCOTCH AND ENGLISH STEAMERS.

"Nemo me impune lacessit."

Sir,—Having been in the *British Queen* to New York, I was, on my return not a little amused, and, I confess, somewhat indignant, at three letters which I found inserted in your Magazine of 27th ult., and of 3rd and 24th inst., under the signatures of "Observator," and "Piston." Surely Scotchmen must have forgotten their national motto, to allow the writer (for I will show that they were all three written by the same person) to insult and traduce them with impunity. That the three letters are the production of the same identical rabid animal, who indiscriminately snaps at, and bites both friends and foes, and scatters his *scottophobia virus* among them, must be self-evident from the following statement, which he makes under the name of "Piston." "I should not have *again* adverted to the unlucky *British Queen*, had there not recently appeared in your journal a bold inflated letter from Mr. Samuel Hall." Now how is it that the writer says he should not *again* have alluded, &c.? He has never *before* alluded to the *British Queen*, under the signature of "Piston." He must, therefore, refer to his having done so under that of "Observator." This gentleman, call him by which of the two names you please, ex

pressed himself extremely angry with the directors of the British and American Steam Navigation Company, for presuming to judge for themselves, and for sending the *British Queen* from London to Glasgow, for her engines; but not content with this, he conveys a mean insinuation against the Glasgow engineer, (viz., Mr. Robert Napier,) to whom the furnishing of the engines of the *British Queen* was confided, by stating the astounding fact that he was a namesake of the person who has made so many boilers which have exploded and caused so great a loss of life. Now, what has Mr. Robert Napier to do with all that other gentleman's exploits. Can any thing be so illiberal as this wholesale mode of vituperation? Mr. "Piston" is aware that such steam engines as those of the *Dundee*, the *Perth*, the *London*, the *Commodore*, with many others, and last, though not the least, those of the *British Queen*, will establish Mr. Robert Napier's reputation too strongly to be shaken by the united efforts of Mr. "Piston" and all his brother engineers of the Thames put together. Mr. "Piston" trys to put the engines of the *British Queen* in the shade by his telling us that her engines were put in at Glasgow, while those of the *Great Western* were the "*chefs d'œuvre* of Maudslay and Field of *London*." Well has it been said, "save me from my friends," especially when they are so foolish and indiscreet as Mr. "Piston." What is the present state of these *chefs d'œuvre* of Messrs. Maudslay and Field? I can state from actual inspection of them at New York, that the side frames of the engines are broken in many places, and are held together by malleable iron straps. What again was the condition of the boilers, and of the insides of the cylinders and of the pistons? Why the two latter are furrowed and injured to a serious degree, owing, no doubt, to the gritty and earthy matter that is sent into the boilers, and finds its way into the engines. These effects, and a constant deposit of hard scale in the boilers, take place, notwithstanding the application of Messrs. Maudslay's and Field's other *grand chef d'œuvre*, the brine *pumps; things* which are so very complex *and troublesome, and* of such uncertain *operation, that I* can only compare *their use to ploughing* with dogs when put in competition with the process on board the *British Queen* of supplying pure water only to the boilers. From what I saw of these engines and boilers, I prognosticate that the *Great Western* will not be able to perform more than another voyage across the Atlantic and back without being compelled to be laid up to receive new framing and undergo other extensive repairs of both her engines and boilers. I also prognosticate that the much calumniated engines of the *British Queen* will not require similar repairs to their frame-work for twenty years, and that the boilers will last ten or twelve years at least, owing to their being supplied with distilled water (containing a small portion of oil) instead of salt or dirty water, and consequently not having any scale to chip off or otherwise requiring cleaning, I may observe, *en passant*, that I see that all the abuse of Mr. "Piston" is not confined to poor Scotland, as I perceive that an Englishman, Mr. Samuel Hall, the patentee of the condensers which effect the objects I have just described, comes in for an ample share. But Mr. Hall may laugh at all the brine-pumps and other abortive attempts to supersede the necessity of his condensers, which, however, much they may be opposed by interested parties must ultimately come into general use. Among other things, I observe that "Piston" gives his friends at the Admiralty what he means to be a rather severe censure, in the following words: "Within these last twelve months, however, our *economical* government have been buying some cheap ready hatched things." Now I really think this sort of ambush-fighting is both ungracious and ungrateful in a person who has received such extensive favours from our *economical* government. Besides, is he not aware that the first Lord and several other Lords of the Admiralty are Scotchmen as well as the first engineer Peter Ewart, Esq., and that the illiberal and unmerited attack upon Scotchmen generally and indiscriminately cannot be very agreeable to them from a person whom they have gone such lengths to patronise and to serve. On this subject, I shall very likely have a good deal more to say at a future time, when possibly real instead of fictitious names may be used in our correspondence. I have, however,

a good deal more to do in our masquerade characters, with the three notable letters for which I have not now time, but which I may probably attend to next week, when I may probably inflict more severe stripes on Mr. "Piston," than, in my tender mercy, I have hitherto done, in the mean time,

I am, Sir,

Your very obedient servant,

PISTON-ROD.

London, August 24, 1839.

[From what we know of the authorship of the letters of "Observator" and "Piston," we must say that our present correspondent labours here under a great mistake. Who the person he points at is, we know not; but of this we are certain, that to neither "Observator" nor "Piston," have his imputations the least application. ED. M. M.]

THE "GREAT WESTERN" AND "BRITISH QUEEN."

Sir,—Although the superiority of London-made engines over Scotch ones is too well established to need any further comment on my part, yet I think some of your London correspondents should be careful not to eulogize too much the capabilities of their engines. The recent letter of "Observator" has called forth these remarks, and I wish also to make a few observations on one or two other subjects in his letter. As to the Americans placing too much confidence in the *British Queen* by overlooking the fact of her being fitted with "Scotch engines," and betting very highly on her, I understand the fact was quite the contrary, as the odds were more in favour of the *Great Western* making the best passage to England. I admit that on three days only the average daily rate of miles performed on the voyage home by the *British Queen* exceeded those of the *Great Western*; but if "Observator" had compared the logs of the two vessels, he would have found that on the two last days, the 13th and 14th of August, the *British Queen* gained amazingly on the *Great Western*. After all, the *Great Western* reached Bristol only about two hours before the *Queen arrived at Portsmouth*, having left New York ¾ths of an hour before her, and I have very little doubt, the latter would have overhauled the former had they both pursued the same course. Of the two vessels, I decidedly prefer the *Great Western* for her engines, which are an incomparable piece of workmanship, but for build and elegance of mould give me the *British Queen*.

The advice in the first part of this letter, I think is equally applicable to some of your Scotch correspondents also, and I wish that "Constant Reader," who has put forward some very strong assertions without being backed by a single "fact," and in the face of undeniable statements, against the safety of London made steam vessels, and in favour of "Clyde-built ones," would take it home to himself. I trust the discussion which has from time to time appeared in your pages respecting the "rival engineers" will have this good effect, viz. in inducing the Scotch to wipe of the name they have got for bad workmanship, and to pay more attention to the safety of the public who travel by their boats. That it may have this effect is the earnest wish of ever yours, &c.

BOWSPRIT.

MESSRS. BUNNETT AND CORPE'S NEW STEAM-ENGINE.

Sir,—It is amusing to observe the "note of preparation," and the puffery with which novelties are frequently introduced, and from the benefits of which "old friends with new faces," are by no means excluded. I allude, in the present instance, more particularly, to the patent engine of Messrs. Bunnett and Corpe, recently introduced to the notice of your readers by your indefatigable correspondent Mr. Baddeley, under the imposing appellation of the "lion of the mechanical world," (page 212). It is not my intention to offer any remarks on the novelty of that form of engine, which, I dare say, is familiar enough to most mechanics, nor on that peculiar modification of it, which Messrs. Bunnett and Corpe claim as their own; neither is it necessary, for practical men, that I should more than allude to the very questionable nature of the advantages which the patentees suppose they gain by their retro-

grade movement from simplicity to complexity, in the form, number, and arrangement of the parts, as compared with the simple and efficient cylinder engine, to say nothing of the difficulty which, amongst other things, must attend the mechanical execution of such forms as circular cylinders, circular piston-rods, circular stuffing-boxes, and square pistons. My object, in the present communication, is to notice some tables furnished by Mr. Baddeley, in which is shown the comparative force required to move a crank through one-fourth of its stroke, upon what he calls, "the new and the old principle," and from which he deduces the remarkable conclusion (page 212) that "*upon mechanical principles alone, the power gained is full one-third more than is attainable in the ordinary reciprocating engines,*" and from other tables given in your last number (page 253) he makes the advantage gained to be "*more than one-half in favour of the concentric engine on mechanical principles alone, independent of other sources of superiority in the working of the valves, and the efficient application of steam power.*" Now, the inference which must inevitably, and which I suppose was intended should be drawn, from this statement is, that by the application of *a new principle in mechanics, hitherto unknown*, the engine contrived by Messrs. Bunnett and Corpe, can develop upwards of 50 per cent. more power than engines on any other construction, or by any other makers! If this is not the correct deduction will Mr. Baddeley be good to say what meaning the paragraph was intended to convey, and how much of it he believes himself, and would have others believe; and, moreover, if he is satisfied himself of the correctness of his conclusions, will he inform us by what happy art of reasoning he brought himself into so favourable a mood for the marvellous? If he can succeed in convincing the "mechanical world" that the concentric engine possesses advantages over all others equivalent to one hundred per cent. (as shown by his figures) or even fifty or thirty, then indeed it will deservedly be the "lion," and far from needing the assistance of a "Bottom," may, with perfect *security, be left to do its* own "roaring."

Mr. Baddeley will perhaps perceive, *that the ground on* which he claims superiority for Messrs. Bunnett and Corpe's engine, has, in fact, nothing whatever to do with the respective merits of that, or any other mode of applying steam, but rests simply on the difference between applying the power from the cylinder to the crank by means of parallel slides, or by the intervention of the common beam.

I shall not notice "the other sources of superiority in the working of the valves and the efficient application of steam power," as from the phraseology I presume they are not intended to convey any meaning, much less the insinuation that Messrs. Bunnett and Corpe are the first engineers who have "worked valves properly," or "used steam efficiently." The whole affair reminds us of the remark made by a celebrated reviewer, which, by a little adaptation, may serve for the concentric engine. "The book," he observes, "contains much that is new, and much that is true, but what is *new* is not *true*, and what is *true* is not *new*.

I remain, Sir, yours very respectfully,

JOHN LEONARD.

Railway Office, Cromford, Derby,
August 8, 1839.

EXPLANATION OF THE LETTER OF "MYNHEER VAN HOOM-BOOGD," ON MESSRS. BUNNETT AND CORPE'S PATENT CONCENTRIC STEAM-ENGINE.

Sir,—Since the publication of your last number, I have been requested by Messrs. Bunnett and Corpe to explain an article which you did me the honour to insert therein, respecting their engine, and I beg, therefore, to trouble you with a few words for that purpose.

I have been seriously charged by them with having *asserted, as a fact*, that their engine *has been* tried by some great, but unknown, foreigner, and, by him, been found not to answer; this same assertion being, they say, much to the detriment and injury of them, the said Messrs. Bunnett and Corpe, and against the peace of our sovereign lady, &c. &c.

But, Mr. Editor, is it possible that at this time of day—in the year 1839—in the present age of enlightenment and march of mind—is it possible, I ask, that any readers of your Magazine require seriously to be told that there are

no such persons in existence as "Mynheer Van Hoom-boogd," the "A.S.S.," &c., and his man "Tom Commonsense?" Is it possible that any one could be found who would so scandalously libel his own intellects as to say that he understood the letter in a literal sense, and could infer from it that the patent concentric engine had been really purchased by this great unknown, erected at his manufactory, and found to fail? It cannot be; the supposition is too preposterous and absurd to deserve a moment's consideration. It is, however, the wish of the patentees that I should explicitly inform all whom it may concern, that I have not the pleasure of being acquainted with any such person as "Mynheer Van Humbugged" or "Hoom-boogd, A.S.S., &c.," nor do I know any one at all who either has tried or would be likely to try their engine. The supposed letter was only intended (and I defy any one laying claim to an ordinary share of intelligence to put any other construction upon it) to state an imaginary case, in order to convey, more easily and clearly, the following ideas which I had formed respecting the invention:—

Firstly. That, from the unequal wear, the working parts of the engine would be subject to; and from the difficulty there would be found in keeping the various curves perfectly "concentric," after being in use a length of time; the engine would most probably be continually leaking and getting out of order, and would become worse and worse every day.

Secondly. That if the piston rod were straight, and the piston moved in a straight box instead of a curved one these difficulties would not arise.

Thirdly. That *ergo* to make these parts so, would be a decided improvement.

Fourthly. That the patent engine, so improved, if "set over the shaft destined to receive motion from it," would be exactly Boulton and Watt's engine, but something inferior.

Fifthly. That the arm, I, ("to some remarkable property of which a great part of the advantage gained by the engines seems to be ascribed,") is *precisely* the semi-beam of the old engine, but a little shorter than generally made.

Sixthly. (By inference) That since no one ever yet dreamt that one-third more power could be obtained by shortening the beam of the old-fashioned engine; the experiments in pp. 212, 253, have, it is probable, given an erroneous result.

Messrs. Bunnett and Corpe have thought fit to charge me with having written the article alluded to, for the malicious purpose of injuring them. Now, Sir, is it to be endured that your correspondents are to be subject to accusations of this kind, for merely expressing their opinions of inventions published in your Magazine? The fact of their being there invites discussion; and I totally deny that I transgressed in the least the ordinary bounds of legitimate criticism in this article so offensive to Messrs. Bunnett and Corpe. If any deductions or inferences contained in it are fallacious, as they very possibly may be, let Messrs. Bunnett and Corpe prove them to be so, and as to the opinions, we know that (thanks to your impartiality, Mr. Editor,) they *may* be expressed whether *pro* or *con*, but after all they are but opinions. I do not want any one to adopt mine unless they examine for themselves and find sufficient reason. Why should I wish to injure Messrs. Bunnett and Corpe? I only know them by their revolving shutter, and I cannot but admire and respect the talent which could devise and perfect such an ingenious and useful invention; I earnestly hope that it will amply repay them, as I have no doubt it is doing at the present time; but I cannot help lamenting that such talent is, as it strikes me, so unprofitably employed upon the invention before us; from which, I fear, such happy results as those above alluded to, will never proceed.

I have to apologise, Sir, to you, for thus occupying your pages in what seems to me to be a needless and uncalled for way; but it has been at the express desire of Messrs. Bunnett and Corpe; and your readers must, therefore, blame them, and not me, for the loss of so much space in your next number. I could have wished that their communication to me had been written instead of verbal, I would then have forwarded it to you for insertion.

I would, in conclusion, just hint to Messrs. Bunnett and Corpe, that if they wish to serve their own cause, that

object will be better attained by bringing forward facts and arguments to prove the advantages of their engine, than by paying hostile visits to those who may chance to commit the heinous crime of differing from them in opinion, and threatening them with actions at law.

I am, Sir,
With all respect,
Your obedient servant,
W. P.

32, Windsor Terrace, City Road,
August, 22, 1839.

RECENT AMERICAN PATENTS.

[*Selected from the Franklin Journal.*]

WHITE PIGMENT TO BE USED AS A SUBSTITUTE FOR WHITE LEAD, *William Cumberland, New York.*—"The first operation in preparing my white pigment (says the patentee) is to obtain a protoxide of lead by triturating metallic lead in water, to which I in general add a portion of caustic soda, to facilitate the process. This production of a protoxide of lead by trituration is now practised in some manufactories of carbonate of lead, and is not of my invention, but the means which I have adopted of effecting it, facilitates the process, and is as follows:—I granulate the lead, by fusing it, and pouring it into water, in the ordinary way. This lead I put into a triturating vessel, differing in construction from the cylinders usually employed. This vessel is somewhat in the form of a saucer, or bowl, so as to expose a considerable surface to the action of the atmosphere; it may be of cast iron, and of such size as shall adapt it to the quantity of work to be performed. An iron shaft passes through the axis of this vessel, and is attached to it so that they may revolve together. The shaft is inclined twenty-five degrees, more or less, from the perpendicular, and motion is communicated to it in any convenient manner.

"The shaft need not run through the vessel, but may be supported in a collar below it. The body of the vessel may be made entirely of lead, or of any other metal, and lined with lead; its form may be varied considerably.

"Into the vessel so constructed, I put my granulated lead, with as much water as may be requisite, adding about an ounce of caustic soda to every four gallons of water. The revolution of the axis, combined with its inclination, and that of the triturating vessel, causes the granulated lead to roll over, and *thus produces* the necessary friction among *its particles, and also the* requisite exposure *to the influence of the* atmosphere, in the *most advantageous way.* This operation is usually kept up for about twelve hours, when the oxide of lead which has been formed, and which is of a pale yellow colour, is seperated from the metallic lead, and well washed. During the process, portions of water are added to supply any loss by evaporation or otherwise.

"I have thus given the mode of producing the protoxide which experience has shown to be a very good one, and I believe the best; but I do not limit myself to this particular mode of forming the protoxide, but occasionally take this oxide prepared in any other way, and submit it to the subsequent operations by which the pigment in question is formed.

"The yellow protoxide, produced as above, or the protoxide obtained in any other way, is to be placed in a vessel, with a considerable quantity of water, and diluted sulphuric acid is then poured among it, agitating the mixture not only during the pouring, but for a considerable space of time, and it will be found that the protoxide of lead will be thereby converted into a white pigment, which is a peculiar sub-sulphate of lead, possessing properties not found in the ordinary sulphate of lead; the quantity of sulphuric acid required will be about two pounds to every twenty pounds of the oxide. The ordinary sulphate is obtained by precipitating the lead from any of its soluble salts by means of sulphuric acid; as from the acetate or nitrate of that metal; the sulphate so produced will be a white powder, but it will not possess the body, or other properties, which fit it to be substituted for the carbonate of lead in painting; whilst that prepared in the way which I have indicated will be found to possess these properties in an eminent degree."

WREST PIN FOR PIANO FORTES, *Daniel Walker, New York.*—Instead of the wrest, or turning-pin, generally used in piano fortes, a screw is to be used to move a nut which has the string attached to it. In the block which receives the turning pins, standards are to be inserted which rise vertically from the block to the height of about two inches. A screw with a square head is to pass through a projecting piece on the upper end of the standard, its point resting on a metallic stop. This screw passes through a sliding nut, one edge of which is guided up and down by a groove in the standard, and to this nut the wire is attached. At the lower end of this standard there is a small pulley, around the lower side of which the wire passes, extending from it along the instrument. The claim is to "the application of the nut, screw, and pulley, as above described, as a substitute for the ordinary turning pin."

CONSTRUCTING AND MANAGING VATS FOR TANNING LEATHER, *Wm. and J. C. Rouse, and S. Taylor, Bedford, Virginia.*—The system of vats, which form the subject of this patent, are to operate upon a principle which has been before essayed and approved; that of establishing a communication through the system by means of hollow trunks, allowing the ooze to be transferred from one vat to another. The variation in the manner of carrying out this principle adopted by the patentees, has been deemed sufficiently original to be made the foundation of a patent. The bark is to be contained in a moveable reservoir, or box, perforated to admit the fluid, and capable of being raised by a windlass and transferred from one vat to another.

The claims are to "the manner of arranging the aqueduct, or tubes, at or near the lower parts of the vats, in combination with those at a greater elevation, but in no case approaching the upper portion of the vats, so that the ooze may be transferred from one to the other, substantially in the manner set forth. Also the manner of connecting the lay-away vats with the first series, as set forth, so that the strong liquor may, at pleasure, be conveyed into them, in the manner set forth. We likewise claim the moveable reservoir, or vat, for containing the bark."

SMITH'S FORGE, *Amos Binney, Pennsylvania.*—A cast iron box is to be built into the hearth of the forge. The upper side of the box is to be a few inches below the surface of the hearth, and is to be covered by grate bars. The bottom of the box is made to slide, and it can therefore be withdrawn; through one side of this box there is a hole for the introduction of the wind from the bellows. The coal is, of course, to stand upon the grate, and the forge is, in general, to be used in the ordinary way; but when it is desired to keep up a glowing fire, without the blast from the bellows, the sliding bottom is withdrawn, and a natural draught of air admitted to the fire; a hood of sheet iron is then placed above the coals, to increase the draught.

The patentee says:—"I do not claim the constructing of a cast iron or other box covered by a grate, and receiving the blast through an opening below said grate, this having been before used." He then claims the combining of the sliding bottom with such a box and grate, for keeping up a continuous fire, with the aid of the hood, as described.

HEARTH OF BLAST FURNACES, *George Poe, Elkridge Landing, Maryland.*—"The nature and object of my invention consists *in conveying the melted* iron into a reservoir placed on the outside of the furnace hearth, by means of a channel cut entirely out of the bottom stone, the object of which is to leave the iron in such a situation as to be accessible at all times for casting without interfering with the operation of the furnace. This channel may be differently formed, and the reservoirs be differently situated about the furnace hearth, as may best suit the purposes for which the invention is intended."

After the foregoing, the patentee describes and represents the particular manner of procedure which he has adopted, and claims the invention, generally, as above described.

INCREASING THE STRENGTH OF WROUGHT IRON AND STEEL, *Walter R. Johnson, Philadelphia.*—This invention the patentee states in his specification to be the imparting strength to wrought or malleable articles of iron and steel, "by means of a process which I call thermo-tension;" the following is a full and exact description. The process is founded on the principle that the strength of the materials is increased by means of mechanical stretching, or straining, at a high temperature.

"I first determine in the usual manner, by trial and calculation, what strain might, at the ordinary temperature of the air, and before my improvement has been applied to it, be sufficient to break the particular piece of metal, or manufactured article, intended to be improved by the process of thermo-tension. I then, by means of any suitable apparatus for applying heat and measuring temperature, subject the piece or article to be strengthened, to a temperature not exceeding seven hundred degrees Fahrenheit, preferring that of five hundred and fifty degrees for most kinds of iron, not restricting myself, however, to the same temperature for all kinds of iron and steel, but varying to a higher or lower temperature, according as the same shall be found most serviceable for the particular kind which is undergoing the process. When the proper temperature has been attained, I apply, by means of any suitable apparatus for applying and measuring mechanical strain, a force equal, or nearly so, to the calculated strength of the specimen or article under process, and continue to apply the same as long as the metal continues to be stretched by it.

"I contemplate the application of the improvement and process above described, herein called the process of thermo-tension, to the metals, wrought or malleable iron and steel of whatever form, in which an increase of direct cohesion may be found useful, whether the same have been manufactured by rolling, hammering, drawing, or

by any other process, as I do not confine my improvement to any particular form of materials, or of articles manufactured therefrom.

"What I claim as my improvement in the art of manufacturing iron and steel, and of articles formed therefrom, is the submitting of them, while at high temperature, to mechanical stretching, or straining, as above specified, for the useful purpose of increasing their direct cohesion, by whatever means the necessary force shall be applied, and measured, or the requisite temperature communicated and regulated."

EASTWICK AND HARRISON'S EIGHT WHEEL LOCOMOTIVES.

[*From the Franklin Journal.*]

It is well known to engineers, that the efficiency of the locomotive engine depends, first upon the quantity of steam which the boiler may be capable of generating in a given time, and secondly on the amount of friction, or, as it is technically termed, adhesion, between the driving wheels and the road. As the adhesion increases with the weight, it is evident that the engine becomes more effective by increasing its weight, and by throwing a greater proportion of its weight on the drivers.

But a limit to this increase of weight arises from the incapacity of the road to sustain the great pressure thus thrown on a small bearing surface.

To obviate this difficulty, engines have been made with all the wheels coupled so as to constitute them all drivers, and thus distribute the *adhesive* pressure over a greater extent of the road.

Engines of this description are used for heavy and slow draught, but are considered unsafe, from their liability to be thrown off the track at curves.

Another plan, patented a few years back by an engineer of this city, was to use four drivers, and at the same time to carry the front end of the engine on a guide truck, as in the six-wheeled engine. But here a new difficulty arose in consequence of the engine having three points of bearing in the line of the rails, on which its weight could not be properly distributed, unless the road was entirely free from irregularities of surface: a condition not to be found on any of the roads which have come under the notice of the committee of the Franklin Institute.

The improvement invented by Messrs. Eastwick and Harrison is designed to obviate this difficulty, by giving to the eight-wheel engine only two bearing points, one *on the guide-truck* and the other on a frame supported by the driving wheels. The axles of the drivers are placed one in front, and the other behind the fire-box, and are confined between pedestals of the usual form fixed to the main frame of the engine, which allow vertical play, but prevent any horizontal motion.

The bearing pins, instead of abutting against springs fixed to the frame in the ordinary manner, are jointed to the extremities of horizontal beams of cast-iron, one of which is placed on each side of the engine.

To the centre of these beams or levers, are jointed wrought iron rods, which pass down through the engine-frame, and carry the springs which support the weight of the engine. The connecting rod of the piston is attached to the hinder wheel, and this communicates motion to the front driver by a coupling-rod attached by a ball and socket-joint.

It is evident that this arrangement will allow to each driving-wheel an independent vertical motion, with the advantage that the engine will partake of only one half the vertical motion of either wheel, in consequence of being suspended at the centre of the horizontal sustaining beam.

The front drivers are without flanches, in order to avoid any difficulty in turning curves.

EXPERIMENTAL RESEARCHES UPON THE COST OF THE LIGHT AFFORDED BY DIFFERENT LAMPS AND CANDLES. BY ANDREW URE, M.D., F.R.S., &c.

The author having instituted a series of experiments to determine the advantages of Mr. Parker's new hot oil lamp, adopts as the standard of comparison the French mechanical lamp, in which the oil is raised by machinery, so as continually to overflow at the bottom of the burning wick. The relative illumination was determined by the well known method of the equal intensity of shadows, and verified by that adopted by Professor Wheatstone, namely, by the relative brightness of the opposite sides of a revolving ball.

One peculiar feature of the new lamp is its bell-mouthed glass chimney, above which is a chimney of iron, with a parted diaphragm for the purpose of causing a certain portion of the heat of the flame to reverberate against the interior cylindric cavity of the oil cistern. The bell mouth is formed in a mould, and is far better suited for producing a steady flame than the rectangular constracted chimney of the mechanical lamp. The intensity of the shadows from the mechanical lamp and the hot oil

lamp, of a wire a few inches long and of the thickness of a crow quill. was equal, at a distance of 10 and 11 feet respectively; their relative illuminations being as the squares of these are, as 100 and 121 respectively, and the consumption of the best sperm oil was 15·2 and 11·6 grains per minute; the relative cost of illumination for this oil would thus appear to be 50 per cent. in favour of the new lamp. On trying Southern whale oil the cost of illumination appeared to be about one-third that of the mechanical, and one-half that of the hot oil lamp with sperm oil. The author tried many other substances, and, comparing the various illuminations, concludes that the hot oil lamp with Southern whale oil affords an economy of light nearly 12 times greater than stearine or German wax candles, 7½ times greater than tallow mould, eleven times greater than cocoa nut, 8½ times greater than Palmer's, 17½ times greater than spermaceti, and 18 times greater than wax candles.

The author had also compared the illumination produced by one of the Fresnel Lamps deposited at the Trinity House. The lamp consists of four concentric circular wicks, placed in a horizontal plane, the innermost being ⅞ths of an inch, and the outermost 3½ inches in diameter. The intensity of the shadows from this and from the mechanical lamp were equal at a distance of 13 feet, 3 inches, and 4 feet 6 inches respectively; taking the squares of these the Fresnel lamp gives about nine times the light of the mechanical, which latter may be assumed as equal to that of eleven average wax candles. On comparing one of the best Argand lamps with the mechanical, the former was to the latter as 10 to 11; so that the illumination of the Fresnel lamp, instead of being as has been asserted equal to 40 Argand lamps, is not equal to more than 9·6 of those lamps. In the Bude light a small stream of oxygen is sent up through a small tube within the burning wick, which is ⅝ths of an inch in diameter, and the flame about ⅝ths of an inch. The illuminating power is equal to about 30 wax candles. Dr. Ure also examined the illuminating power of different kinds of wax candles, and found that the light from a long-three and a short-three was the same, or $\frac{1}{11}$th of the mechanical lamp; also the light emitted from one of the six-to-the-pound was very little less, being $\frac{1}{12}$th of that of the mechanical lamp. The consumption of wax in a long or short-three may be taken at 126 grains per hour, and in a short-six at 125 grains per hour.

Wax contains 81·75 parts of carbon in every 100 parts, and the combustion of these 100 parts produces 36 parts of carbonic acid; consequently, a wax candle will generate per hour about 375 grains of carbonic acid, or 800 cubic inches of gas. Now an average sized man developes and exhales from his lungs 1,632 cubic inches of gas per hour; thus the combustion of two ordinary wax lights deteriorates the air to about the same extent as the breathing of one man.—*Trans. Inst. Civ. Eng.*

LOCOMOTIVE POWER APPLIED TO CANAL TRANSIT.

On the 21st and 22d instant an experiment was conducted on the Forth and Clyde Canal, of a novel and highly interesting nature, by John Macneil, C.E., and consulting engineer to the Canal Company. It is well known that the haulage of boats on this canal has hitherto been performed by horses, the rates of speed being for the heavy sloops, brigs, &c., in the London, Dundee, and other trades, about 1½ to 2 miles per hour, when drawn by 2 or 5 horses according to the state of the weather, and for the swift or passenger boats between 8 and 9 miles per hour, on an average, when drawn by two horses. The object of the experiment was to ascertain the possibility of using locomotive steam power to draw the boats instead of horses; accordingly, a single line of rails, upon blocks, like an ordinary railway, was laid down for a considerable space along the canal banks, near lock 16; and a locomotive engine and tender built by Mr. William Dodds, having been brought down the canal and set on the rails, on the morning of the 21st, Mr. Macneil, Mr. Johnston, the canal director, and several engineers and gentlemen, being present, the experiment commenced by attaching to the engine the towing line of the first passenger boat that made its appearance, and which contained upwards of 90 passengers, with their luggage. There was a trifling delay in disengaging the horses and tying the line to the engine, but this was amply compensated when the "Victoria" briskly set off, and almost immediately gained a speed of 17½ miles per hour, which she kept up round two curves, and until the termination of the rails made it necessary to stop, amid the cheers of the delighted passengers. This experiment was repeated, during the course of the day, with each passenger boat as it came to the railed space, and with equal success each time. On one occasion a towing rope, which was much decayed, got foul with a curb-stone and broke, but without causing the slightest inconvenience, except about one minute's delay. The engine em-

ployed being intended only for a slow trade, was not calculated to go at greater speed than 18 miles per hour, but it was the opinion of all present, that with proper passenger locomotives, a speed might be obtained, equal to that upon the best railways, few of the latter possessing the advantage secured by the canal bank of a *perfect level* throughout.

The nature of the motion was highly gratifying to all the passengers, being more uniform, steady, and smooth than when the boats were drawn by horses.

Several of the heavy (masted) vessels were also taken in tow during the two days of trial, at the rates of 3, 3½, 4 and 5 miles per hour; and, on one occasion, two loaded sloops, and a large waggon boat, were together attached to the engine, and hauled with ease at the rate of 2¾ miles per hour, whilst only *one-fourth* of the steam was allowed to pass the throttle valve.

The foregoing statements render palpably apparent the immense advantages which might be gained by this new adaptation of steam power —a great economy in haulage expenses, as one engine might draw at least six sloops, which now would require from 18 to 24 horses, and, if necessary, at double the present speed; and a proportional increase of the important traffic on the canal, which might be reasonably expected.

Passengers would increase in a great proportion, when attracted by economy and speed of transport. The Union Canal might be traversed in two hours, and the Forth and Clyde Canal in 1½, instead of 4 hours and 3½, as at present, and this by only assuming 16 miles per hour, though more might easily be performed, as the experiments have shown.

NOTICE OF MR. CHARLES TENNANT.

The Institution (of C. I.) have to regret the loss, by death, of Mr. Charles Tennant of Glasgow, the eminent practical chemist. Mr. Tennant was born at Glenconna in Ayrshire, in 1767, and commenced his career as an improver in the chemical arts before the end of the last century. The great revolution in the practice of bleaching, which then occurred, was carried out by the discoveries made by him, first of the solution of chloride of lime, and afterwards of the dry chloride of lime, or bleaching powder—an inestimable gift to the arts with which the name of Mr. Tennant will always be associated. The chemical works of St. Rollox near Glasgow, which now form so conspicuous a monument of his energy and success, were erected for the purpose of manufacturing *this article*, for which he held a patent.

The manufacture of sulphuric acid, and of alkali from salt, was also greatly improved at St. Rollox, and first conducted there on a scale commensurate with their national importance. The manufacturing interests of this country possess an advantage in the extraordinary cheapness of these and other chemical products, which they owe in a great degree to Mr. Tennant's scientific talents and activity as a manufacturer.

The arts are deeply indebted to Mr. Tennant for other benefits, particularly for his exertions in removing the duty on salt. This he ultimately succeeded in accomplishing, after a struggle of many years with the Kelp proprietors. Few legislative enactments have been so beneficial to the country, as is well attested by the rapid increase of alkali manufactories.

For some years past Mr. Tennant left the chief management of his manufacturing affairs to his sons, and devoted a great portion of his energetic mind to the welfare of his fellow-citizens, among whom he was considered a leader in every philanthropic undertaking.

The success of railway undertakings occupied latterly much of his time and attention; the last great struggle in which he was engaged, was in favour of the Edinburgh and Glasgow line; the passing of the bill for which, he had the happiness to live to see. He died at his house in Glasgow on the 1st of October, aged 71, and has left a name which will long continue to be extensively known and associated with practical science.—*Report of Inst. of Civ. Eng.*, 1839.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 22nd JULY, AND THE 26th AUGUST, 1839.

William Colchester, of Ipswich, merchant, for an improved soap frame. Patent dated July 29; six months to specify.

Christopher Nickels, of York-road, Lambeth, gentleman, for improvements in cutting India rubber. August 1; six months.

Louis Francois Feuillet, of Paris, but now of George-yard, Lombard-street, London, gentleman, for improvements in casting type for printing. August 1; six months.

Samuel Sidney Smith, of Suffolk-place, Hackney-road, merchant, for certain improvements in machinery for raising water. August 1; six months.

Joseph Webb, of Huddersfield, York, for improvements in machinery for raising the pile of woollen and other cloths. August 1; six months.

Alphonse Rene le Mire de Normandy, of Cheapside, Doctor in Medicine, for certain improvements in the manufacture of inks and dyes. August 1; six months.

William Abbott, jun., of Wyndham-place, Middlesex, gentleman, for improvements in the manufacture of felt. August 1; six months.

Thomas Knowles, of Manchester, cotton spinner, for certain improvements in machinery or apparatus used in the preparation of cotton and other fibrous substances. August 1; six months.

William Miller, of Clithero, Lancaster, engineer, for certain improvements in grates used in steam-engines, or other furnaces or fire-places. August 1; six months.

Pierre Jacques Ferier, of No. 5, Paul's-chain, St. Paul's church-yard, jeweller, for certain improvements in the construction of vapour and hot-air baths. August 1; six months.

Samuel Guppy, of Bristol, merchant, for improvements in a certain process and apparatus used in the manufacture of soap. August 1; six months.

William Morrett Williams, of Bedford-place, Commercial-road, for an improved lock and key. August 1; four months.

John Humphries, of Kidderminster, carpet manufacturer, for certain improvements in the manufacture of carpets and rugs. August 1; six months.

John Mercer, of Oakenshaw, Lancaster, calico printer and chemist, John Dyneley Prince, of Manchester, and William Blythe, of Church, chemist, for certain improved processes to be used in the printing, dyeing, or colouring of cotton, woollen, silk, or other cloths and yarns. August 1; six months.

Sir John Scott Lillie, of Kensington, knight, for certain improvements in the application of elastic fluids to the working of machinery. August 1; six months.

John Moore, of Broad Weir, Bristol, gentleman, for an improvement or improvements in the steam-engine, or steam-engine apparatus. August 5; six months.

Jonathan Fell, of Workington, Cumberland, for improvements in building ships and other vessels. August 5; six months.

Robert William Jearrad, the younger, of Oxford-street, architect, for certain improved means of retarding wheeled carriages. August 6; six months.

Joseph Whitworth, of Manchester, engineer, for certain improvements in machinery, tools, or apparatus for planeing, boring, and cutting metals or other substances. August 7; six months.

Thomas Burr, of Shrewsbury, lead merchant, for improvements in rolling lead and other soft metals. August 8; six months.

John Fitzpatrick, of Stanhope-street, Clare-market, gentleman, for a new and improved method of making and manufacturing thread and linen by means of a material not hitherto used for that purpose. (A communication.) August 10; six months.

Robert Varicas, of Burton-crescent, Middlesex, surgeon, for improvements in rendering fabrics and leather waterproof. August 10; six months.

Nelson John Holloway, of Pentonville, Middlesex, gentleman, for an improved head for carriages. (A communication.) August 13; six months.

Henry Brown, of Mile-end, Middlesex, for a new covering or plating for household furniture, picture frames, cabinet and fancy work, and other articles of domestic and personal use, and the mode of making such covering or plating. August 13; six months.

Miles Berry, of Chancery-lane, for a new or improved method of obtaining the spontaneous reproduction of all the images received in the focus of the camera obscura. (A communication.) August 14; six months.

James Capple Miller, of Manchester, gentleman, for certain improvements in printing calicoes, muslins, and other fabrics. August 15; six months.

John Mason, of Rochdale, Lancaster, machine maker, for certain improvements in machinery or apparatus for boring and turning metals and other substances. August 15; six months.

William Bridges Adams, of Porchester Terrace, Bayswater, gent., and John Buchanan, of Glasgow, coach builder, for certain improvements in the construction of wheel carriages, parts of which improvements are also applicable to machinery for propelling, and also for the purpose of securing ships and other vessels, and for communicating motion between different portions of machinery. August 16; six months.

Joseph Schofield, of Littleborough, Lancaster, cotton spinner, and Edmund Leach, of the same place, manager of cotton spinners, for certain improvements in looms for weaving various kinds of cloth. August 17; six months.

Matthew Uzielli, of King William-street, London, merchant, for improvements in the modes of impregnating wood or timber with chemical materials. (A communication.) August 17; six months.

George Augustus Kollman, organist of her Majesty's German Chapel, Saint James's, for improvements in railways and in locomotive and other carriages. August 17; six months.

James Vardy, of Wolverhampton, gent., and Moritz Platow, of Poland-street, Oxford-street, engineer, for improvements in making decoctions of coffee and other matters. August 17; six months.

Stephen Joyce, of Croydon, Surrey, artist, for certain improvements in stoves for warming the air in buildings, which improvements are also applicable for cooking or for communicating heat for other useful purposes. August 21; six months.

Moses Poole, of Lincolns' Inn, gent., for improvements in introducing elastic materials into fabrics to render them elastic, or partly elastic. (A communication.) August 23; six months.

William Coles, of Charing-cross, in the county of Middlesex, esq., for improvements in reducing friction of machinery used in propelling vessels, lathes, and other machines. August 23; six months.

Charles Barwell Coles, of 35, Ailsop Terrace, New Road, Middlesex, gent., for improvements in the method of fixing and carrying fire-arms on horseback. August 23; six months.

John Augustus Tulk, of Seaton and Lowen iron works, Cumberland, iron master, for improvements in the manufacture of iron. August 26; six months.

Henry Pinkus, of Old Slaughter's Coffee House, Saint Martin's-lane, gent., for improvements in the methods of applying motive power to the impelling of machinery, which improvements are applicable to several useful purposes. August 26; six months.

James Bogardus, of Trinity-square, Tower Hill, gent., for improved means of applying labels, stamps, or marks to letters, and such other documents. August 26; six months.

Thomas MacGauran, of Golden Terrace, Pentonville, Middlesex, for improvements in the manufacture of paper from a material not hitherto so employed. August 26; six months.

John Muir, jun., merchant, in Glasgow, for certain improvements in the apparatus connected with the discharging press, for conducting, distributing, and applying the discharging liquors, and the dyeing liquors. August 26; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN 22ND OF JULY AND 22ND OF AUGUST, 1839, INCLUSIVE.

John Evans, of Birmingham, paper manufacturer, for improvements in the manufacture of paper. Sealed 23d of July, 1839.

John Alexander Elzear Degrand, of the Boulevard du Temple, Paris, but now of Covent Garden, for improvements in the production of motive power and in machinery for applying the same to useful purposes. July 23.

Edward Francois Joseph Duclos, late of Samson, Belgium, but now of Leicester-place, Leicester-square, gentleman, for improvements in the manufacture of zinc, copper, tin, and antimony. July 23.

Charles de Lavaleye, of King's Head Court, Shoe-lane, in the city of London, engineer, in consequence of a communication from a certain foreigner residing abroad, for improvements in the manufacture of bricks. July 23.

Theodore Cotelle, of the Haymarket, Middlesex, civil engineer, for improvements in extracting salt from sea or salt water, and rendering it pure and drinkable, and in purifying other waters. July 23.

William Newton, 66, Chancery-lane, civil engineer, in consequence of a communication from a foreigner residing abroad, for certain improvements in engines to be worked by air or other gases. July 31.

Robert Griffiths, of Smethwick, Staffordshire, for certain improvements in the construction of presses, which improvements are also applicable to the raising of weights. August 1.

Joseph Jennings, of Bison Bridge, parish of Ker, county of Cornwall, Assay Master, for a process for obtaining metal from pyrites, or mundic. August 1.

Christopher Binks, Middlebie-street, Newington, near Edinburgh, for certain improvement in obtaining, or manufacturing chlorine, and certain compounds of chlorine, applicable in bleaching. August 2.

David Stead, of Great Winchester-street, London, merchant, partly a communication from a foreigner, and partly his own discovery, for an improved mode or method of making or paving public streets and highways, and public and private roads, paths, courts and bridges, with timber or wooden blocks. August 6.

John George Shuttleworth, of the Mount near Sheffield, soap boiler, for a new mode of obtaining a rotary motion from the rectilinear motion of the piston rod of a steam or other the like engine. August 8.

George Holworthy Palmer, of Surrey-square, county of Surrey, civil engineer, for certain improvements in paddle-wheels, for propelling ships, boats, or other vessels navigated by steam or other motive power. August 16.

John Rostron, of Edenfield, County of Lancaster, cotton spinner, in consequence of a communication from a certain foreigner residing abroad, for certain improvements in looms for weaving. August 16.

William Henry Hornby, of Blackburn, county of Lancaster, cotton spinner, and William Kenworthy, of the same place, cotton spinner for certain improvements in the machinery for sizing and otherwise preparing cotton, wool, flax, and other warps for weaving. August 17.

John Mercer, of Oakenshaw, county of Lancaster, calico printer and chemist, John Dynelay Prince, the younger, of Manchester, calico printer, and William Blyth, of Church, in said county, manufacturing chemist, for certain improved processes to be used in the printing, dyeing, or colouring of cotton, woollen, silk, or other cloths, or yarns. August 7.

John Buchanan, of Glasgow, coach builder, and William Bridges Adams, of Porchester Terrace, Bayswater, Middlesex, gentleman, for certain improvements in the construction of wheel carriages, parts of which improvements are also applicable to machinery for propelling, and also for the purpose of securing ships and other vessels, and for communicating motion between different parts of machinery. August 22.

LIST OF IRISH PATENTS GRANTED IN JULY, 1839.

Joseph Jennings, for a process for obtaining metal from pyrites or mundic.

John Player, for improvements in furnaces and fire places for consuming anthracite and other fuel for generating steam, evaporation, melting, and heating iron and other metals.

Thomas Wilkinson, for certain improvements in the construction of tram or railways, and in the carriages to be used thereon.

Thomas Vaux, for certain improvements in tilling and fertilizing land.

E. Samuell, for improvements in the manufacture of soda.

NOTES AND NOTICES.

Electro-Magnetic Power.—Dr. Jones, the Editor of the *Franklin Journal*, in mentioning a patent for a mode of changing the poles of electro-magnets, states—"It has now become almost certain that the attempts to obtain motion with power sufficient to render it available in the driving of machinery, by electro-magnetism, cannot be successful, from causes inherent in the principle whose aid is invoked; and that if it is ever obtained, it must be the result of discoveries which will lead the experimenter into a new channel."

Whitelaw's Water Mill.—This new mode of applying the power of water we have previously noticed. It is an invention, which will in all probability supersede most of the water wheels now in use, and is applicable where water wheels cannot now be adopted, as in high and small streams, or in very low falls. The engine, which was stated (p. 79) as having been put up at Mr. Sterrat's works, near Paisley, to the present time, continues to work most admirably—nine-tenths of the weight of the water being obtained as effective power. It is also as completely under controul as a steam engine, and has likewise a self-acting governor. One of the most striking proofs that the whole of the power of the water is exhausted before it issues from the arms of the mill, is, that although they are revolving at a speed of 180 revolutions a minute, the water drops quietly from their mouths on the floor of the mill, in which there is not the slightest current. We understand that an engine is in the course of construction for the Shaws Water Works—and not a single wheel has been erected in the neighbourhood since Mr. Whitelaw entered the field—all are waiting the result of his operations.

Steam-Boat Race.—In our last number we published some particulars of the *Royal George*, iron steamer, extracted from a Dumfries paper. On the night of Saturday last she commenced her first trading voyage from Glasgow to Liverpool. The proprietors of the wooden steamers were determined not to be beaten, and announced that the *Commodore* should start at the same time, viz., ten o'clock at night, from the Broomilaw. Both vessels were, however, afraid of trusting their reputation to the chances of running aground in the Clyde—the passengers and luggage were, therefore, taken from Glasgow to Greenock in small steamers. The *Commodore* started from Greenock about ten minutes before the *Royal George*, and kept increasing the distance thus gained, during the night and the greater part of the next day; for the last fifty miles, however, the *George* was gaining considerably on the *Commodore*, and in coming up the Mersey had a decided advantage, in consequence of drawing so much less water than her competitor, (two feet). The *Commodore* ultimately beat the *Royal George* by about *twenty minutes*. This voyage of the *Commodore* is the shortest passage between Glasgow and Liverpool ever performed, having been done in 16¼ hours. The wooden vessel had, certainly, the disadvantage of the iron in point of *build*; her draft of water was two feet more; two feet more beam, and a hundred tons more register: to make up for this, her engines were of fifty horse power more than the *George's*.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

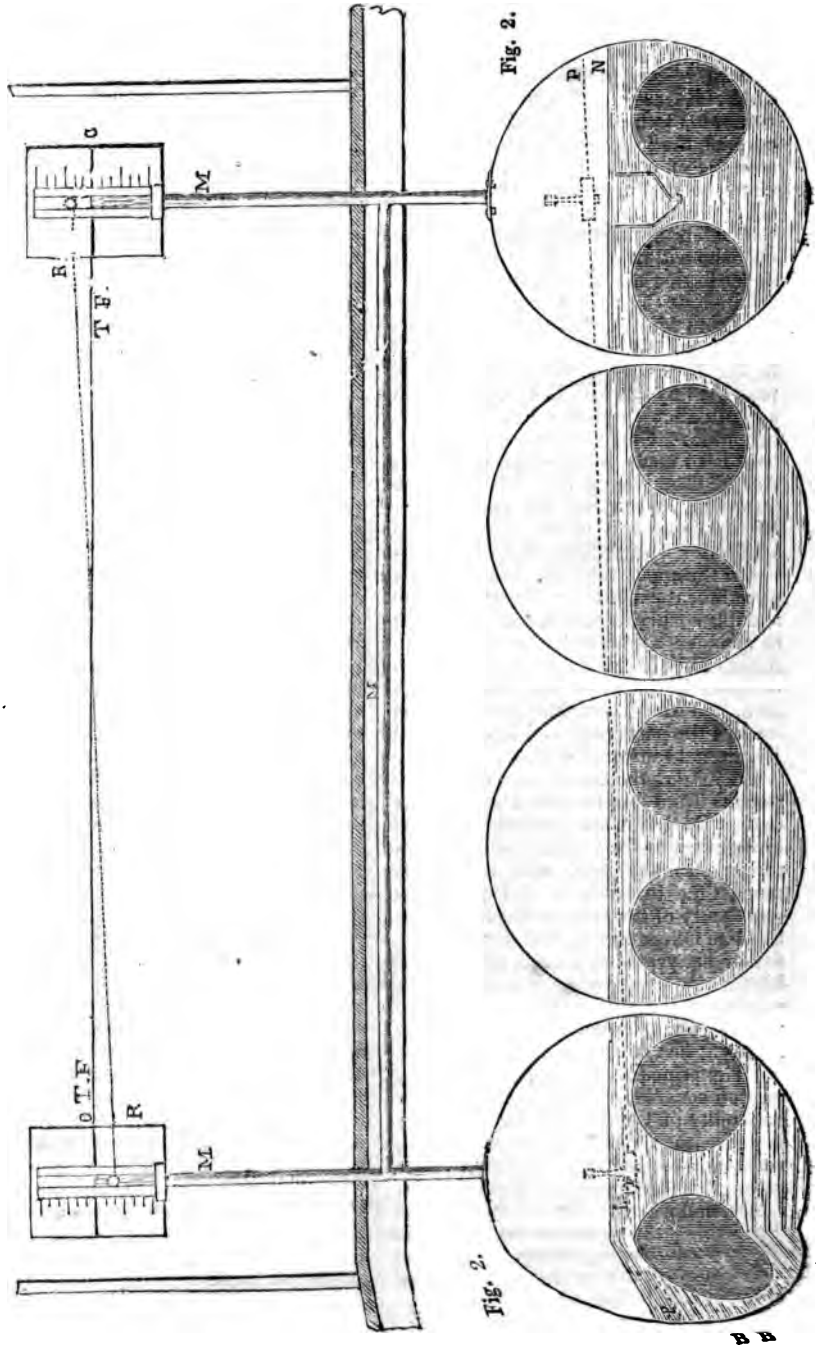
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 839.] SATURDAY, SEPTEMBER 7, 1839. [Price 3d.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

EVANS'S STEAM BOILER SAFETY GUARDS.



EVANS'S STEAM BOILER SAFETY GUARDS.

Brother Jonathan is always "going ahead"—in profession, if not in practice. Mr. Cadwallader Evans, an engineer of Pittsburg—son of the late well-known Oliver Evans—has been proclaiming throughout the States that he has discovered the long-sought desideratum—a means of rendering the explosion of a steam-boiler impossible. He advertises his apparatus for sale, and at the same time offers five thousand dollars to any one who will produce the explosion of a boiler having his invention attached!

Amongst the papers forming the appendix to Messrs. Parke's and Pringle's Report, we find a copy of a Memorial to the Congress of the United States, presented by this Mr. Evans, praying an appropriation to enable him to test his invention. This application appears to have been made in accordance with the Act of Congress, a copy of which we published in our last vol. (xxx) p. 13. We are not aware of the result of the application—but presume that he has tested the apparatus well, either at the government expense or his own, before making so high a vaunt, and assuming so confident a tone, as he has done in the American publications. The apparatus certainly is the most complete we have seen, and would doubtless be efficient so long as the parts remained in order, and it were not tampered with.

We extract the description of his apparatus from his memorial. He states that "He has, from his infancy, been brought up to the business of manufacturing steam-engines, and has spent much time in studying the principles and theory of the same under his father, the late Oliver Evans, and for the last five or six years has employed much of his time in discovering a mode of preventing the explosion of steam-boilers, which, your petitioner flatters himself, he has at last discovered.

"The principle of your petitioner's invention consists, first, in preventing the possibility of there ever being a greater pressure than desired; second, it prevents the possibility of the boilers ever getting beyond a certain and safe temperature, and relieves the pressure at that *time; third*, the water in the boilers is *prevented from ever getting* too low or *too high, without due notice* being given *by the sounding* of a horn or whistle, and thereby fully enabling the passengers to keep a boat in proper trim. This invention informs you whether the deficiency of water is owing to the careening of the boat, or the force-pump being out of order, and not supplying. With this apparatus placed on a boiler, and enclosed within a metal case, under lock and key, your petitioner conceives that it would be absolutely impossible to burst it, should it even be attempted.

"The whole apparatus is uncommonly simple, and not at all liable to get out of order.

"Strange as it may appear, by your petitioner's improvements the passengers in the cabin can see distinctly the relative situation of the water in the boilers, as it regards the flues, at all times; and when the whistle or horn sounds, you can see the exact quantity of water that is in one boiler more than another, also the exact quantity the engineer uses above the flues, even to a greater certainty than if the ends of the boilers were made of glass. This is accomplished by the most simple application of the water-level, which can be seen by reference to the accompanying drawings.

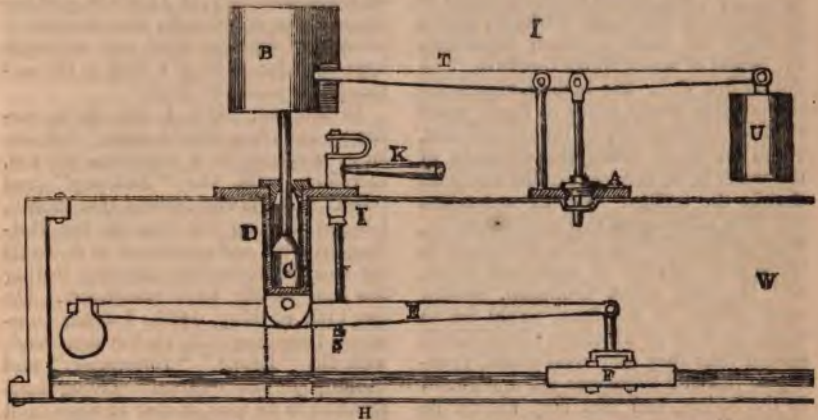
"Fig. 1 represents a boiler with flues, having the safety-guards attached. A, represents a common safety-valve, with the lever extending to, and into, an oblong slot in the weight B; C is a fusible alloy, placed in the brass tube D, which extends into the boiler, W, five or six inches, or, if thought advisable, to the top of the flue, H; E is a lever, secured by a joint to the bottom of tube D, on the end of which lever is suspended the float, F; I, is a small valve, opening into the boiler; K, is a horn. Fig. 2 (see front page) represents the end of a boiler, showing a sectional view of a sheet-iron case, L, which encloses the float, F, to prevent the ebullition or any current of water in the boilers affecting the operation of said float. Fig. 3 represents four boilers with double flues, with the water-level MMM, which is a copper tube of about one inch diameter, being, in length, equal in distance from centre to centre of the outside boilers. This tube being placed under the cabin floor, having the ends turned up, and passing into the cabin, on the ends of which tube are placed glass tubes, alongside of which is secured a graduated scale, with the broad black marks, O O. These marks are on a line

parallel with the top of the flues of the boilers. This level must be supported from the boilers, having no connexion with the wood-work of the boat. This apparatus is enclosed in a metal case, under lock and key.

The object and operations of the above-described apparatus are as follow:—

1st. The safety-valve, A, relieves the boilers of any superabundant pressure of steam. Should the water begin to get too low, the float F, descending, brings the lever, E, to press upon the

Fig. 1.



button, S, and causes the valve, I, to open and blow the horn, K,—the apparatus placed on the other outside boiler, blowing a whistle. The operation of this float does not only tell you that the water is too low, but informs you whether it be owing to the careening of the boat, or the force-pump being out of order, or the water shut off; because, if the whistle or horn sound alone, the deficiency is to the careening; and, if horn and whistle sound together, they inform you that there is a general deficiency of water, and that the pump is not working properly. But, should it so happen, from any cause, that the temperature of the boilers was about to become too great, the alloy C would fuse, and the weight B, being no longer supported, would descend, and press upon the end of the lever T of the safety-valve, and counterbalance the weight U, and allow the steam to escape, let the pressure be what it may, and effectually relieving the boilers at the time they might become weakened by over-heating. At the same time that the valve A is opened by the descent of weight B, it also raises a small valve placed in a pipe leading from the cold-water pump to the fire, and effectually extinguishes it. The object and use of the water-level, as represented by fig. 3, is, to enable the passengers and all on board of a boat to see the exact relative situation of the water, as it regards the flues of the boilers; also the exact quantity of water the engineers work with in the boilers, although it has no connexion with the interior of the boilers; to understand which, observe the following explanation: 1st. As noticed before, the black marks O O are in an exact parallel line with the tops of the flues. We suppose, for instance, the floats F blow the horn and whistle when the water is just even with the top of the flues; then suppose the horn and whistle are heard to sound at the same time, by looking at the level you would see that the water in it would be exactly up to the black marks O O, which may now be called the top of the flues. If there be water above the top of the flues when the boat is on an even keel, and any careening of the boat takes place, and the horn or whistle sounds alone, by casting your eyes on the level at that time, you will see distinctly, by examining the variation of the water in the level, from the black marks O O, double that variation or distance for quantity or height of the water above the flue in that outside boiler which has not caused the notice, while

that which caused the sound is just about becoming exposed. The actual distance or variation shows the exact height of water there would be above the flues, if the boat was on an even keel. For instance: measure the distance from under the small ball (as represented in the engraving, and which floats on top of the water in the level) to the black mark O O, and it will be found equal to the height of the black mark, N, drawn through the boilers, which represents the height of water above the flues. The dotted line P, in the boilers, represents the position of the water in them when the boat is careened; and the dotted line, R, on the level, shows the situation of the water in it, being a parallel line with that in the boilers. Muddy water has but little effect upon this apparatus; 1st, because there is very little difference in the specific gravity of mud and water, and the only effect produced, should mud adhere to the float, would be to cause the horn or whistle to sound a little sooner than they otherwise would, proving to you that there was too much mud in the boilers, and that they should be cleaned."

STEAM CARRIAGES ON COMMON ROADS —MR. HANCOCK IN REPLY TO COL. MACERONI.

Sir,—I am sorry the letter of Col. Macéroni, in No. 836, professing to be a reply to mine in No. 832, should have made it necessary for me to beg a few lines by way of rejoinder.

In the first place, the Col.'s letter is no reply at all to mine, no, not to a single point; your readers, therefore, can only come to one conclusion on the subject, that silence was the most convenient course. The whole burden of the Col.'s letter refers to my preferring "deeds" to "words," and although I cannot discover that he disputes this conclusion, yet it appears to have caused considerable uneasiness.

The Col. refers to a number of newspaper reports *in his favour*, and claims to have completely got the start of me there, and to this I readily agree, but, nevertheless, I beg to inform him, that I have a large box full of both London and provincial journals and periodicals, (some 14 or 15 years old) with several *foreign papers, all sent to me by friends,* who have observed in them notices both for and against my performances.

Then a nobleman (who has honoured me also with a trial and commendations) and two or three gentlemen are mentioned as having seen and spoken in praise of his carriage; very well, this is in the way of "deeds," and, *therefore,* good, but would not the Col. charge me with absolute folly, *if I were to particularize a few individuals, and to refer to newspaper reports,* after my carriages have been for so long a time *in the service of the public at large?*

In August, 1834, I had three carriages, including the "Infant," but the latter was not in a condition for use, therefore, with the "Autopsy" and "Era" *only,* on the 18th of that month, I began running for hire on the Paddington road, and continued to do so till the end of November, carrying during this time nearly 4000 passengers. On the 11th of May, 1836, I again commenced running daily on the same road, with the "Erin,*" "Enterprise," and "Autopsy" (the "Infant" having been repaired to be used in case of need) and I continued running, *with these only,* until the middle of July, when the "Automaton" was added, until I ceased about the middle of September; during this time I ran about 4200 miles, carried 12,761 passengers, and passed through the city to Stratford, more than 200 times. The "Autopsy's" engines are too small; she was, therefore, never a very efficient carriage. The "Infant" had done a great deal of work, and could not be much relied on; therefore, till July, the work was principally done by the "Erin" and "Enterprise," and, after that time, with the addition of the "Automaton," that is, with three carriages, or, with the two inefficient ones, five carriages.

Now, the Col. says emphatically that I employed twelve! I most willingly leave your readers to decide upon the veracity of the two statements. The Col. says it was an "easy road," Mr. Ogle says, "Mr. Hancock took the most difficult road for a steam-carriage in England."

As the Col. seems partial to newspaper reports, I will refer him to one in the *Morning Chronicle* of the 19th of August, 1834, in which the writer says:—"No roads in the neighbourhood of the me-

* Altered from "Era" on repainting before taking it to Dublin, Dec., 1834.

tropolis, and few in the kingdom, are more difficult to travel, than that which Mr. Hancock has chosen for scene of his operations."

I have never attempted any deception in running my carriages; if I had been inclined to this, I should have built them all as nearly alike in outward appearance as possible, and not have distinguished them each by a different name, printed on both sides, and at front and back, in conspicuous characters; if the substituting one in repair for one out of repair, (as the Col. states) was so frequently necessary, I can only say that I took the very worst means of deceiving the public, that any man could have adopted.

By the word "daily" in the preceding statement I beg to be understood to mean every day consecutively, (Sundays excepted) notwithstanding the Col.'s insinuation to the contrary. He says, the carriage built by him (and Mr. Squires) ran "daily" for eighteen months, which makes me think that this word "daily" admits of some latitude in its acceptation; and by the same rule I may say that instead of eighteen months, I have run many years.

The Col. says that I could keep only one carriage running, and yet the public saw two passing each other on the road continually, by the same legerdemain he makes me to possess *fourteen carriages!!* I might go on and compare the Colonel's roads, and short distances to Uxbridge, Edgeware, and Harrow, with those of mine to Brighton, Birmingham, Marlborough, &c. &c., but I imagine enough has been said to enable your impartial readers to judge between us—this is all I desire.

The Col. recommends to me the running of one of my carriages to Cambridge, &c. Now as the company formerly called the "Maceroni," has changed its designation to that of "Common Road Steam Conveyance Company," possibly their plans may also be changed, and if they are disposed to employ my carriages to Cambridge, I will go whenever they please; this will be a far better way of undoing the mischief to steam locomotion on common roads, hazarded by the Col.'s injudicious letter, than any other course that I can take.

I am, Sir, your obedient servant,

W. HANCOCK.

Stratford, Essex, Aug., 1839.

SUBMARINE GALVANIC TELEGRAPHS.

My dear Sir,—I have just read, and with great delight, the account of the experiment made so successfully of communication by the galvanic telegraph between London and Drayton; the tube containing the wire running parallel with the railway.

In the description of what Sir Walter Scott calls, and so justly calls, "the gorgeous vision of Ezekiel," it is said of "the living creatures" that "they had the likeness of men;" that "whithersoever the spirit was to go, they went; thither was their spirit to go;" and that "the living creatures ran and returned as the appearance of a flash of lightning."

The spirits of those living creatures, men themselves, to which the living creatures of the vision of the Prophet "had the likeness," by means of this magic telegraph now run and return;—as the appearance even of "a flash of lightning they run and return," and hold their communion on the galvanic wire!!

As my scientific meditations have been for many years, as you know, greatly devoted to the subject of submarine (or rather more strictly, subaqueous) operations, one of the first impulses of my mind on reading in the newspapers the account of this triumphant experiment, was to commence an investigation of the question how far this communication was capable of being transmitted by sea, as well as by land.

Submarine physical science does not yet afford resources to enable men to descend into "the fountains of the great deep," but who shall presume to affirm that this shall not be matter of commonplace occurrence in future ages?

The present age may (and does, too) vaunt its palmy superiority of knowledge over the ages past away; but yet it is only now that man, instead of being perfect in sapience as an intellectual being, an "intelligential substance" is, as it were beginning (I take an exquisite metaphor from Akenside) to "*hunt nature into her elements*" in physical science.

In the first place it is quite evident that at any depth at which divers can work, pipes might be laid, and secured at the bottom, through which wires might pass between any two points required.

But as there is a limit of depth for divers which cannot be exceeded, it is

evident that some other mode must be had recourse to, if we want to make the invention available, say for example, between London and Dublin, and London and Paris.

That which I am now about to lay before your readers in all the crudeness of a first thought, is in theory, (if I may in such manner express it) so ridiculously simple, and must so inevitably occur to many thousands of those who read the account of the experiment, that I have very great doubt whether it is worth the trouble of publishing. This is a matter, however, on which you are to decide.

I first take Port Patrick and Donaghadee, (the shortest sea passage) and assuming that wires are passed in tubes from London to the former place and from Dublin to the latter, as also from London to Dover, and from Calais to Paris.

It is quite evident that if a line of steamers of sufficient power to keep their places steadily, and without being drifted by the winds and tides and currents, were to be interposed between Ireland and Scotland, between the ports above named, and between England and France in the same manner, and that a flexible wire were to be passed through a flexible and water-tight tube, and then were to be passed over rollers placed in each of the steamers interposed in a line between land and land, the communication could be effected.

This crude theory assumes, that the galvanic action is not affected by distance, and also assumes that the tube shall hang so deep in the water after falling from the roller in each steamer, that there shall be no danger of its being broken or injured by ships holding their course at right angles, or obliquely to its direction. The steamers used for the purpose, would be thus, as it were, *moored upon the deep*, amidst the complicated action of currents and winds and tides, by the almost omnific agency of the Spirit of Fire.

The bodies of the living creatures called Irishmen and Frenchmen could not go over land and through the two seas, but assuming what I have stated to be practicable, it is quite clear that the minds of the people of Dublin and of *Paris could, through the* medium of *London, hold communication* with each other on any subject whatever in a few moments!

The effluence of their souls, their thought, and even "as a flash of lightning," could "go and return!!!"

Although as an Irish Protestant O'Connellite Agitator, it may be presumed that I am not a person peculiarly diffident, and partaking of the qualities of the sensitive plant, and of the blushful rose, yet I admit frankly that I feel half ashamed of putting on paper for the readers of your invaluable periodical, a plan so utterly obvious to every one who thinks for a moment, as that which I have described; many of them will, no doubt, after reading it, exclaim in soliloquizing, "It needs no ghost come from his yawning grave to tell us that"—

However, it is not utterly impossible that some good may result from it, by setting the minds of your readers to work to produce something excellent in contrast to its imperfection.

I shall send you an article on a theory which occurred to me some time ago, of an application of the oxyhydrogen gas light to the purposes of submarine illumination. It occurred to me while observing Mr. Deane's operations on the coast of the county Clare, and which I described in a general manner at a meeting of the London Institution of Civil Engineers. About ten years ago, I published in the *Mechanics' Magazine* an article on the same subject, viz., illumination by means which I then recommended, by a lamp in the water with a concave reflector.

I have the honour to be, Sir,
Your very sincere friend,
THOMAS STEELE,
A Member of the Senate of this University, and of the Mechanics' Institute of Limerick.

Magdalene College, Cambridge, Sept. 2, 1839.

BURSTALL'S PATENT PNEUMATIC CARRIAGE SPRING, RAILWAY BUFFER, AND ELASTIC DRAG.

[*Communicated by the Inventor.*]

The principle feature of this invention (as shown in the annexed engravings) consists in applying the elastic properties of the air for the springs and buffers of railway carriages, and is best performed by inclosing in a metal cylinder an air-tight vessel constructed of

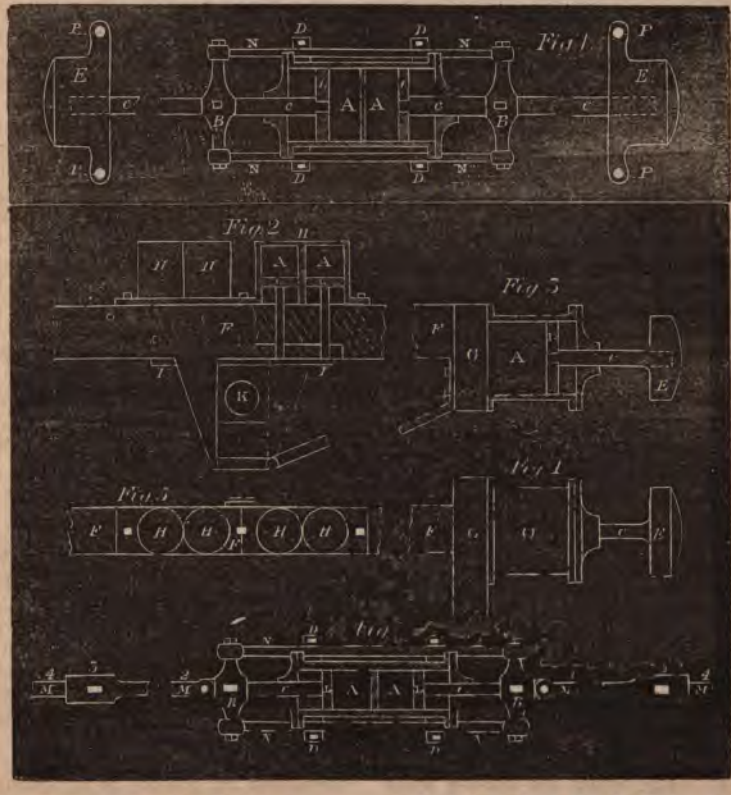
caoutchouc, or caoutchouc and silk or cotton, such as the well known preparation of Mr. Mackintosh, or some of the animal tissues, or any other flexible substance which can be made air-tight.

Fig. 1 is a plan, and shows a double cylinder, its pistons, buffers, &c., (the cylinder being in section,) to indicate the situation of the air-vessels.

Fig. 2, 3, 4, and 5 are plans and sections of a part of a locomotive steam carriage frame, with four of the springs; the buffer, cylinder, and part of the frame, being in section as in fig. 1.

Fig. 6 is a plan of an elastic drag, and an improved method of connecting a train of carriages together.

In fig. 1, A A are those parts of a cylinder (which is constructed with a partition in the centre to make it into two) in which the air vessels are to be placed; L L are two pistons for compressing the air vessels; C C the piston rods on which the cross heads B B are to be securely fixed; the outer ends of the piston rods C C being extended to the full length of the carriage for the purpose of fixing the buffers E E; the bars across the buffers with the holes P P P P are for the purpose of fixing drag chains to connect one carriage to the next in the train; the cylinder (as only one will generally be required) must be bolted by the four lugs D D D D to the centre of the car-



riage; the two cross heads B B are connected together by the side rods N N to cause the two pistons to act together, or as one is compressed against the one air vessel, the other will be relaxed according as the carriage is moved forward or backward, and as the buffers are fixed to the end of the piston rods, the concussion will be received through them on the corresponding air vessel.

In fig. 2 and 5, F F, is part of the side frame of a railway steam carriage; fig. 3

being the plan, and fig. 2 the elevation, with part in section; HHHH are four cylinders, and may be seven to ten inches long and five to seven inches diameter, two being shown in section and two in elevation; together they form a powerful carriage spring on the same principle as the above described buffer, with air vessels, pistons, and piston rods: the cylinders may be made of cast iron, cast in one piece, and must be bolted upon the top of the carriage frame; K is the axle of the carriage, with its brass bearing guided by the iron frame in the usual way, on this brass a strong iron bar II is fixed, and on which the four piston rods of the springs stand so that the compression of the air vessels in the cylinders AA may produce the required elastic action.

In fig. 3 and 4, GG, is the end framing of a steam carriage, fig. 3 being a section of that, and a buffer to be placed at the end of the carriage, while fig. 4 is a plan; this buffer is constructed and acts on the principle before described, and is for the protection of the carriage, when either pushing a train before the steam carriage or when one carriage is propelled against another.

Fig. 6 is a plan of an elastic drag, on the same principle and construction as fig. 1, except, instead of the two buffers the elongated piston rods are provided with a socket joint and key to connect the train together, as at M 3 and 4, and two horizontal joints as at M 1 and 2; these joints being for the purpose of allowing the train of carriages, however long, to conform without stress or strain to any curve of the railway. By this plan the whole train will be locked together by what will be, in effect, a complete bar from end to end; while each carriage being only acted on through the medium of the elastic air vessels, will be freely at liberty to take its natural place on the railway bars and any oscillatory motion which any individual carriage may receive, will end with itself, instead of as at present being propagated backwards and forwards from one end of the train to the other, while any sudden shock will be received on the air vessels the same as if provided with buffers.

As in this method of supporting carriages and forming railway buffers, advantage is taken of two of the most elastic substances in nature, it principally remains to show there are no practical difficulties in the way; this will be clear from the fact, that the air vessel is so completely supported by the cylinder, that a vessel made by expanding with a syringe one of the common caoutchouc bottles, sold by the stationers, weighing only one ounce, and enlarged till it was less than 1-40th of an inch thick, bore, without symptoms of failure, a gross weight of upwards of three hundred pounds, equal to fifty pounds to the inch; which was likewise the case when a sheep's bladder of less than one quarter that weight was put into the cylinder.

In constructing the single buffer, as in fig. 3 and 4, it is recommended that they be made seven or eight inches diameter, or containing fifty to sixty circular inches section; this, if pressed by concussion to half its length, will give a resistance of about seven hundred pounds; if into 1-4th, two thousand pounds; or if into 1-8th, five to six thousand pounds; but so long as the cylinder is strong enough, it can never be brought home.

In the elastic drag, fig. 6, cylinders of five inches diameter will be fully sufficient, as the utmost draught of each carriage may not exceed one hundred pounds; and as each carriage will have its own independent spring, this will give a power of compression of four pounds only to each circular inch; while in case of any sudden stopping, as the air vessel may bear one hundred pounds to the inch, a resistance of about two thousand pounds may be received without any prejudice to the spring.

M. DAGUERRE'S PHOTOGENIC PROCESS

Sir,—So the process of M. Daguerre is at last made public, and you will hasten, I doubt not, to give it to your readers. It will, I fear, disappoint the expectations both of the artist and of the man of science—the former, because of the fragile nature of the effects produced, and which, though very beautiful and delicate, are too microscopic, and too dependent on position to substitute for art, or to give them any other claim to our notice, than as very interesting objects of scientific curiosity—and the latter, because it was generally believed that M. Daguerre had discovered some black substance, extremely sensitive to

solar light in reference to its blacking power, so that he was enabled to produce the lights through the effect of light, and from shadow to shades. It appears, however, that primarily the process is essentially the same as that which Wedgewood, Talbot, and others have practised in this country, namely, by submitting a preparation of silver to the *blackening* effect of light, and so obtaining the lights and shades in the first instance reversed, the only difference being, that Daguerre uses the iodide and others the chloride of silver. The great improvement then which Daguerre, or Niepce has introduced, consists in again reversing these effects, and restoring the lights and shades to their natural order; and this is effected by two subsequent operations, the first to make the black lines white and of a metallic lustre, and the second to blacken all the remaining surfaces.

Now what is the rationale of this process, of which "M. Arago has formally declared the positive inability of the combined wisdom of physical, chemical, and optical science, to offer any theory, which might be even tolerably rational and satisfactory." Does the following offer a plausible explanation? A thin coat of iodide of silver is formed on the silver surface of the plate. Now the iodide of silver is yellow, and yet iodine blackens silver more powerfully than any body known. How is this? When the iodide of silver is in substance, and by itself, it is under very different circumstances to what it is in a thin coat on a surface of silver; for in this case, through the action of light, it is very favourably disposed to have its silver revived, just as the presence of animal matter in the one case, and of water in the other, disposes the nitrate and the chloride of silver, under the influence of light, to part with their oxygen and chlorine, and leave their silver revived. But the metal so circumstanced, is in a state of such extremely minute division, that it does not reflect light, and hence its blackness. We are to consider then, that the delineations on the plate are traced in lines and breadths, which are marked by a *deposition* of exceedingly fine silver dust upon its surface, being supplied through the action of light by the thin coating of the iodide of silver. Now in order to make these black tracings white, it was a very ingenious thought (and wherein I conceive the great great merit of the discovery lies, and of which Niepce's plates give evidence that he had acted upon the idea) to expose the plate to the *vapour* of mercury, for the tracings are necessarily too delicate to bear the slightest manipulation. The mercury, I conceive, does not amalgamate with the silver dust; for if such were the case, much of the softness of the effect would, I think, be lost, it would be edgy and definite; neither would there arise that peculiarity of a more glistening and striking appearance when viewed from a particular position, and which called to the mind of your reporter of the meetings of the Royal Institution, when viewing some of M. Niepce's plates, the similar appearance seen in the exquisite machine-ruled engravings of Mr. Saxon on glass. (See No. 817.) Now the vapour of mercury when condensed and lodged among the silver dust, is not in such a state of extremely minute division as the silver, for being in the *liquid* form its particles coalesce in globules sufficiently large to reflect light and render them visible. It is difficult to assign a reason why these globules should reflect light in a more brilliant manner only at particular angles, according to the direction in which the vapour strikes the plate; but I think it may be accounted for by supposing that they are in a considerable degree immersed and obscured by the silver dust, and after a different manner, according to the angle which the vertical direction of their fall makes with the surface of the plate, so that the more intense reflection of light being only from certain uncovered portions of their spherical surfaces, and those portions being differently posited under the different circumstances, it can only be seen with brilliance in certain particular positions. The delineations on the plate being whitened by being mercurialised, it only remains to blacken the other parts of the surface, for which purpose one would imagine it would be quite sufficient to expose the plate to the light, but the layer of iodide of silver is so slight, as probably not to give the necessary depth of colour. The plate is therefore immersed in a solution of hypo-sulphite of soda, which further blackens the plate by the formation of a sulphuret of silver. If an amalgam were really produced, would not the hypo-sulphite

of soda tarnish it?—and could an amalgam be formed under the circumstances without the aid of friction? That the silver dust only serves to attract and retain the mercury, is corroborated by the fact, that the delineations are so little fixed that they may be brushed off like a drawing in chalk. If I may be allowed to conjecture, from the evidence of the plates, how far M. Niepce carried the invention, and to what degree M. Daguerre improved it, I should say, that the former employed a different preparation of silver and not so sensitive to light, perhaps the chloride of silver; that he used the mercurial vapour bath; that he placed his plates in an horizontal position, for they were seen to the best effect at an oblique angle; and that he sulphured his plates in order to get a greater depth of colour;—and that the latter introduced the iodide of silver into the process; that he discovered the difference of effect produced by the position in which the plates are laid; and that he originated probably those minute precautions, of which experience taught him the necessity, in order to the production of the best effect. On the other hand, M. Niepce appears to have had a further process, for the purpose of converting the superficial delineations into etchings, though his success in this attempt was by now means complete.

It has been said that Mr. Faraday is acquainted with a process, possibly the same as Daguerre's, which produces similar effects, but which he nobly resolved to withhold from the public until M. Daguerre obtained his expected reward.

I am, Sir, yours, &c.

BENJ. CHEVERTON.

August 27, 1839.

THE DAGUERRE SECRET.

At the weekly sitting of the Academy of Sciences of Paris, on Monday week, the process of M. Daguerre, for the formation of photogenic drawings, was, as had been previously announced, communicated to the public. From an early hour all the seats allotted to the public were occupied, and upwards of 200 persons disappointed of gaining admission, were stationed in a crowd in a court of the Institute, and formed a kind of scientific *emeute*. Every body was anxious to hear the secret, every body to catch the *mot*; all were desirous of learning whether their own scientific conjectures would be confirmed or not.

At three o'clock M. Arago commenced his explanation. We shall not attempt to follow the great *savant* through all the details of his long statement, a large proportion of which related to the history of the discovery—a subject already pretty well known to the public; and we shall only mention so much of that part of it as belongs to MM. Niepce and Daguerre.

The late M. Niepce, M. Arago proceeded to state, appeared to have commenced his photographic experiments in 1814. His first connection with M. Daguerre commenced in 1824, when, through information received from an optician at Paris, he learned that this gentleman was engaged in an independant series of photogenic researches, and especially in trying to fix the images of the camera obscura. They associated their labours in 1829. It is proved that for the photographic copying engravings, and for the formation of plates for engravers, in an advanced state of preparatory sketching of the subject, this gentleman was, in 1826, possessed of the secret of making shades correspond to shades, light parts to lights, demi-tints to demi-tints, &c.; and that he also knew how to make his drawings so produced insensible to the ulterior action of light. The act of partnership, drawn up between M. Niepce and M. Daguerre, and which afterwards stood good between his son and the latter gentleman, states that some entirely new methods had been discovered by M. Daguerre, and that they had the advantage of being able to reproduce images from sixty to eighty times more rapidly than by the processes previously adopted.

It appears that M. Niepce, in his own photographic researches, had first made use of a sheet of silver covered with the purest bitumen (called, in France, Bitume de Judee), which had previously been dissolved in oil of lavender. He used to beat this sheet of silver till the oil was completely evaporated, and only a kind of whitish powder remained adhering to the surface. He then placed the sheets so prepared in the focus of the camera obscura, and obtained the image of the object; but the trace was hardly visible. To obviate the imperfection, M. Niepce next thought of plunging the sheet, when removed from the camera obscura, into a mixture of oil of lavender and oil of petroleum —a method that succeeded, and augured still further improvement; for the image became visible like an ordinary engraving, and on washing the sheet with distilled water left the representation permanent. As a further improvement of this, M. Niepce used a new mixture of sulphuret of potassium

and iodine, but the light acted very slowly upon it, and the iodine, spreading itself over the surface, rendered the image confused and obscure. The oil of petroleum, first used by this gentlemen, was found to have the property of attaching those points of the metallic surface which had been preserved from the action of light by the shades, while it was of no effect on those parts touched by the solar rays.

It was at this stage of the invention that M. Daguerre's labours were joined to those of M. Niepce; and it is only after a long series of experiments, carried on with unwearied perseverance for many years, that after M. Niepce's death, M. Daguerre has at length resolved the problem to its present extent. We omit the history of these experiments, and pass on at once to the actual process as now used by its author.

A sheet of copper, plated with silver, is washed carefully in a solution of nitric acid, which removes from it all the extraneous matters on its surface, and especially any traces of copper from the silver surface. A slight degree of friction is requisite in this process, but it must not be applied always in the same direction. M. Daguerre has observed, that with the friction used in a particular manner, a sheet of copper thus plated with silver answered better than a sheet of silver alone; and he infers from this, that voltaic agency is not unconnected with the effect. When the sheet is thus prepared, it is placed in a closed box, and exposed to the vapour of iodine. This vapour is made to pass through a very fine sheet of gauze, to render its distribution more equable over the surface of the silver; and in order to effect this object which is quite indispensable) more certainly, the sheet has a small metallic rim raised round all its edges. A thin coating, of a yellow colour, is thus formed on the surface of the sheet, which is estimated by M. Dumas at not more than the *millioneth part of a millimetre* in thickness. The sheet, when covered with this substance, is of the most excessive sensibility to light, and is thus ready for the camera obscura. M. Daguerre, in the instrument which he uses, employs a piece of unpolished glass, which he brings first of all into the focus of the lens, in order to determine the exact point at which the sheet should be placed; and, as soon as this is determined, the sheeet is placed accordingly. A few seconds, or minutes, according to the time of day, the state of the atmosphere, &c., suffice for forming the photogenic image; but it is hardly, if at all visible on the surface of the sheet. To make it so, the sheet is placed in another box, and exposed to the vapour of mercury, heated to 60 degrees Reamur, or 167 degrees of Fahrenheit. One of the most curious circumstances attending this part of the process is, that the mercury must act at a certain angle. If the drawing is intended to be seen vertically, it must be suspended over the mercury at an angle of 45 degrees; if it is to be seen at an angle of 45 degrees it must be suspended horizontally. On being taken out from the mercury bath, the sheet is plunged into another bath of the hyposulphite of soda; this solution attacking the parts upon which the light has not been able to act, and respecting the light parts—being the very inverse of the action of the mercury. It may be supposed, therefore, observed M. Arago, that the light parts of the image are formed by an amalgamation of mercury and silver, and the dark parts by a sulphuret of silver, at the expense of the hyposulphite of soda. M. Arago observed that no satisfactory reason had yet been given for this latter part of the process. The sheet is finally washed in distilled water, and the operation is terminated.

The drawing, thus obtained, is perfectly insensible to the action of light, but it is liable to injury, just like a crayon or pencil drawing, and requires to be preserved under a glass case. The effect of the whole is miraculous; and as an instance, we may mention that one of the drayings exhibited by M. Daguerre, on Monday, was the view of a room with some rich pieces of carpet in it; the *threads* of the carpet were given with mathematical accuracy, and with a richness of effect that was quite marvellous.

Such is the process of M. Daguerre; we must add, that it is found that the sun-light does not act equally well at all hours of the day, nor even when the sun is at equal heights above the horizon. Thus the effect is produced better at ten in the morning than at two in the afternoon; and hence the Daguerrotype may be of immense value in measuring the intensity of light.

The camera obscura employed by M. Daguerre may be put in a box two feet long, two feet wide, and two and a half feet high; the price of the whole apparatus may be from 400 francs to 420 francs; the price of each metallic sheet is about three or four francs.

M. Daguerre has entrusted the manufacture and selling of the apparatus to the house of Alphonso Giroux, in the Rue de Coq, St. Honore.

We need hardly say that the most enthusiastic cheers responded from the grave benches even of the Academy, on the termination of M. Arago's description; and the President, M. Chevreul, complimented M. Daguerre in the warmest terms.—*Literary Gazette.*

SELECTIONS FROM THE PROCEEDINGS OF THE BRITISH ASSOCIATION—NINTH MEETING—AT BIRMINGHAM.

[*From the Athenæum Report.*]

Saturday, August 24.

Many circumstances (says our cotemporary) combined to throw a gloom over the opening of the Birmingham session of the British Association. The recent disturbances had rendered it doubtful whether the meeting might not be adjourned to another time and place; foreigners were alarmed by the exaggerated accounts of the riots; and the members of the Local Committee, having their attention engaged by the exciting events around them, could not bestow much of their time on preparations for the reception of the Association. Indeed, under circumstances, it was surprising that their arrangements were so perfect as we found them. Many members, however, were disappointed at the very limited number of manufactories opened to general inspection; and it was thought to be most strange, and was a subject of general remark, that no one of the great engineering establishments, for which Birmingham is so renowned, were found in the list. The Local Committee, however, and all who aided them, deserve great credit for their exertions in collecting together the "Illustrations of Manufactures, Inventions, and Models, &c.," exhibited at the Grammar School, and which did infinite credit to the town, and should, we submit, serve as the basis of a permanent collection of a similar character. All the specimens were interesting or instructive, and many beautiful as works of art.

Measuring the Intensity of Solar Light.—Prof. Daubeny exhibited the model of an apparatus, by means of which, in a more complete condition, he hoped to obtain a numerical estimate of the intensity of solar light at different periods of the day, and in different parts of the globe. The contrivance consisted of a sheet of photogenic paper, moderately sensible, rolled round a cylinder, which, by means of machinery, would uncoil at a given rate, so as to expose to the direct action of the solar rays, for the space of an hour, a strip of the whole length of the sheet, and of about an inch in diameter. Between the paper and the light was to be interposed a vessel, with plane surfaces of glass at top and bottom, and in breadth corresponding to that of the strip of paper presented. This vessel, being wedge-shaped, was fitted to contain a body of fluid of gradually increasing thickness, so that, if calculated to absorb light, the proportion intercepted would augment in a gradually increasing proportion from one extremity of the vessel to the other. Hence it was presumed that the discolouration arising from the action of light, would proceed along the surface of the paper to a greater or less extent, accordingly as the intensity of the sun's light was such as enabled it to penetrate through a greater or lesser thickness of the fluid employed. In order to register the results, nothing more was required than to measure, each evening, by means of a scale, how many degrees the discolouration had proceeded along the surface of the paper exposed to light, during each successive hour of the preceding day. To render the instrument self-registering, some contrivance for placing the paper always in a similar position with reference to the sun, must, of course, be superadded. The object of this contrivance differed from that aimed at by Sir J. Herschel in his Actinometer, being intended as a measure of the aggregate effect of the solar intensity at the period (be it long or short) during which the paper was submitted to its influence; whereas the Actinometer merely measures the intensity at the moment the observation is made. The interposition of an absorbing fluid has at least this advantage, that it enables the observer to estimate the relative intensity by marking the point at which the paper ceases to be discoloured, of which the eye is able to judge more exactly than it could do of the relative darkness of shade which might be produced on paper exposed unprotected to light of different degrees of brilliancy.

Mr. Jackson thought that a Heliostat, for throwing the reflected light of the sun upon the instrument, would be objectionable; and suggested, in preference, that the Heliostat should rather turn the instrument to the sun, which he considered could be effected with equal ease.—Dr. Daubeny assented.—Prof. Forbes only first saw the instrument yesterday; he therefore could not speak with much confidence, but must own his first impressions were not very sanguine of its ultimate success. One objection was, the difficulty, if not impossibility, of procuring prepared or photogenic paper of exactly similar sensibility; and unless this were done, not even the observations of the same person, made at different times, could be compared, much less could any comparisons be made of the results of different observers. Another objection was the difficulty of observing where the discolouration extended to, as the shading off would be so gradual; so that different persons would come to different conclusions, according to the goodness or badness of their sight, upon the very same sheet of register paper. A third objection was, that the scale would be so

complicated, that he much feared whether any scale could be formed; for not only were the quantities of light which would be permitted to pass through a wedge-shaped mass of fluid, such as Dr. Daubeny proposed, diminished, in a geometrical proportion, as its thickness increased arithmetically, but it had now been clearly established by the researches of Melloni, Fresnel, and others, that the portion of light which had already passed through a portion of any medium, was in a state for passing with greater ease, or in a greater relative proportion, through equal portions of the remainder. Unquestionably self-registering instruments of all kinds were highly desirable, and an instrument fitted to perform what Dr. Daubeny proposed, would be both interesting and valuable; and he thought the suggestions valuable, even supposing difficulties, such as he alluded to, should be found to exist.—Dr. Daubeney said, that, as to one of the objections, Sir John Herschel had informed him that any quantity of equally sensible photogenic paper could be obtained; as to the scale, the indications were not intended to furnish absolute, but only relative results.

Daguerre's Photogenic Process.—Mr. Talbot offered a few remarks on M. Daguerre's photogenic process.* M. Arago had stated to the Institute that the sciences of optics and chemistry united were insufficient in their present state to give any plausible explanation of this delicate and complicated process. If M. Arago, who had had the advantage of being for six months acquainted with the secret, and therefore of considering its nature in all points of view, was of this opinion, it seemed as if a call were made on all the cultivators of science to use their united endeavours, by the accumulation of new facts and arguments, to penetrate into the real nature of these mysterious phenomena. For this reason, Mr. Talbot said, he would offer to the section a small contribution, on his part, of new observations which might perhaps be of service towards the elucidation of this new branch of science. The first part of M. Daguerre's process consists in exposing a silver plate to the vapour of iodine, by which it becomes covered with a stratum of iodide of silver, which is sensitive to light. Mr. Talbot stated that this fact had been known to him for some time, and that it formed the basis of one of the most curious of optical phenomena, which, as it did not appear to have been observed by Mr. Daguerre, he would describe to the meeting. Place a small particle of iodine, the size of a pin's head, on a plate of silver, or on a piece of silver leaf spread on glass. Warm it very gently, and you will shortly see the particle become surrounded with a number of coloured rings, whose tints resemble those of Newton's rings. Now, if these coloured rings are brought into the light, a most singular phenomenon takes place; for the rings prove to be sensitive to the light, and their colours change, and after the lapse of a short time their original appearance is quite gone, and a new set of colours have arisen to occupy their places. These new colours are altogether unusual ones; they do not resemble anything in Newton's scale, but seem to conform to a system of their own. For instance, the two first colours are, *deep olive green*, and *deep blue inclining to black*, which is quite unlike the commencement of Newton's scale. It will be understood that the outermost ring is here accounted the first, being due to the thinnest stratum of iodide of silver, farthest from the central particle. The number of rings visible is sometimes considerable. In the centre of all, the silver leaf becomes white and semi-transparent, like ivory. This white spot, when heated, turns yellow, again recovering its whiteness when cold: from which it is inferred to consist of iodide of silver in a perfect state. The coloured rings seem to consist of iodide of silver in various stages of development. They have a further singular property, which, however, has not been sufficiently examined into. It is as follows: It is well known that gold leaf is transparent, transmitting a blueish green light; but no other metal has been described as possessing coloured transparency. These rings of iodide of silver, however, possess it, being slightly transparent, and transmitting light of different colours. In order to see this, a small portion of the film should be isolated, which is best done by viewing it through a microscope. Mr. Talbot said that he had considered the possibility of applying a silver plate thus combined with iodine to the purpose of photogenic drawing, but he had laid it aside as insufficient for that purpose, on account of its sensitiveness appearing to be much inferior to that of paper spread with chloride of silver, and therefore in an equal time it takes a much feebler impression. Now, however, M. Daguerre has disclosed the remarkable fact, that this feeble impression can be increased, brought out, and strengthened, at a subsequent time, by exposing the plate to the vapour of mercury. Another experiment was then related, in which a particle of iodine was caused to diffuse its vapour over a surface of mercury. In order to do this, a copper-plate was spread over with nitrate of mercury, and then rubbed very bright, and placed in a closed box along with a small

* See ante p. 424, 5.

cup containing iodine. The result was, a formation of Newton's rings of the greatest splendour, and of a large size. But they did not appear to be in any degree sensitive to light. The next point of M. Daguerre's process is, the exposure of the picture to the vapour of mercury—and this is by far the most enigmatical part of the whole process. For, he states that if you wish to view the picture in the usual manner, that is, vertically, you must hold the plate inclined to the vapour at an angle of 45 deg., and *vice versâ*. Now this is something altogether extraordinary; for who ever heard of masses of vapour possessing determinate *sides*, so as to be capable of being presented to an object at a given angle? From the hasty consideration which he had been able as yet to give to it, his first impression was, that this fact bore a certain analogy to some others which he would mention. If a piece of silver leaf is exposed to the vapour of iodine, however uniform the tension of the vapour may be, yet it does not combine uniformly with the metal, but the combination *commences* at the edge of the leaf and spreads inwards, as is manifested by the formation of successive bands of colour parallel to the edge. This is not peculiar to silver and iodine, but occurs when other metals are exposed to other vapours: not always with entire regularity, but it displays a tendency to combine in that way. A possible explanation is, that this is due to the powerful electrical effect which the sharp edges and points of bodies are known to possess; in fact, that electricity is either the cause or the attending consequence of the combination of vapour with a metallic body. Again, if a minute particle of iodine is laid on a steel plate, it liquifies, forming a iodide of iron, and a dew spreads around the central point. Now, if this dew is examined in a good microscope, its globules are seen not to be arranged casually, but in straight lines along the edges of the minute striæ or scratches which the microscope detects even on polished surfaces. This is another proof how vapour is attracted by sharp edges, for the sides of those striæ are such. Whether or not these facts had any relation to that observed by M. Daguerre, of the action of vapour at an angle of 45°, Mr. Talbot did not pretend to say, but thought them worthy of being mentioned to the Section. He observed that it had been repeatedly stated in the *Comptes Rendus* of the French Institute, that M. Daguerre's substance was greatly superior in sensitiveness to the English photogenic paper. It now, however, appeared that this was to be understood in a peculiar sense, inasmuch as the first or direct effect of the French method was very little apparent, and was increased by a subsequent process. This circumstance rendered it difficult to institute a direct experimental comparison between them. If it could be accomplished, he doubted whether M. Daguerre's substance would be found much more sensitive than his. The present degree of sensitiveness of the photogenic paper was stated to be as follows: it will take an impression from a common argand lamp in one minute, which is visible though weak. In ten minutes the impression is a pretty strong one. In full daylight the effect is nearly instantaneous. M. Arago had stated that M. Daguerre had obtained some indications of *colour*. Mr. Talbot thereupon referred to his paper to the Royal Society, read last January, (and published in the *Mech. Mag.* No. 810,) wherein he had stated the same thing, which M. Arago has omitted to mention. Since then, more considerable effects of colour have been noticed. In copying a coloured print the colours are visible on the photograph, especially the *red*, which is very distinct. Some descriptions of photogenic paper show this more than others; but no means have yet been found of *fixing* those colours, and sunshine reduces them all to an uniformity of mere light and shade. Sir John Herschel has formed images of the solar spectrum, in which the change of colour is seen from end to end of the spectrum, but most clearly at the red end. Mr. Talbot then mentioned a kind of photogenic pictures which afford a very capricious phenomenon. The objects are represented of a reddish colour on a white ground, and the process leaving the pictures in such a state that they are neither *fixed*, nor yet the contrary, but in an intermediate state; that is to say, that when they are exposed to sunshine they neither remain unchanged (as *fixed* pictures would do), nor are they destroyed (as *unfixed* pictures would be); but this singularity occurs, that the white ground remains unaltered, while the colour of the object delineated on it changes from reddish to black with great rapidity, after which no further change occurs. These facts (he thought) serve to illustrate the fertility of the subject, and show the great extent of yet unoccupied ground in this new branch of science.

Graduating Glass Tubes.—Mr. Coathupe, of Wraxall, read a communication "On an Improved Method of Graduating Glass Tubes for Eudiometrical Purposes." The apparatus for this purpose consists of a truly bored cylindrical tube of iron, into which an iron piston is accurately fitted. Upon the rod of this piston a screw has been cut, with a good pair of dyes, throughout its entire length. The rod was then filed into a triangular form, leaving a suffi-

ciency of the threads of the screw at the rounded angles for an iron nut to traverse with security and freedom. To the upper extremity of this iron cylinder a cap of the same metal is screwed, and into this cap is screwed an iron stop-cock. To the stop-cock is attached a glass graduated measure, with a narrow lip, by means of an iron connecting socket. Near the opposite extremity of the cylinder, an iron diaphragm, of about a quarter of an inch in thickness, is inserted, and is fastened in its place by a side screw or pin, and through this diaphragm, a triangular shaped hole is made, through which the piston-rod can slide easily up and down, but without lateral shake. Below the diaphragm, and at the extremity of the cylinder, the nut is inserted, whose action propels or retracts the piston without the possibility of the piston itself deviating from a right line. This nut enters the cylinder to the depth of about half an inch, and around the entering part a deep groove, in the form of the letter V, is turned, into which the pointed ends of three steel screws enter through the exterior of the cylinder at equal distances, in such a manner that the nut can be revolved freely, but cannot be otherwise displaced. From the entering part of the nut a projecting portion forms a shoulder, which is graduated into equal parts: this projecting portion may be of any diameter greater than that of the cylinder. On the exterior of the cylinder an index is fixed, by means of which any number of revolutions of the nut, or any number of equal parts of a revolution, can be ascertained. To prepare this instrument for use, the piston is to be retracted to its lowest position, and the cylinder is to be filled with mercury, (without air bubbles,) by pouring a sufficient quantity of this metal into the graduating glass that is attached to the stop-cock, and turning the plug for its admission within the cylinder. If, when the cylinder is full, and while some mercury still remains within the graduated glass measure, we turn back the plug of the cock, we get the air-way of the plug filled with mercury; and by pouring off the superfluity, we have the instrument in a proper state to commence graduating any tube for laboratory purposes. Thus, if the tube to be graduated be about one-third of an inch in diameter, if we open the communication between the cylinder and the measure, and propel the piston by one whole turn of the nut, and then close the communication between the cylinder and the measure by turning the plug of the cock, we have within the measure a quantity of mercury, which, when poured into the tube to be graduated, will give a tolerably long space for the first division; and such similar spaces may be repeatedly marked, by repeating the process, until the whole tube be equally divided from end to end. The author referred to Dr. Hare's method of procuring minute quantities of mercury of equal bulk, by propelling a graduated rod of cylindrical wire through a stuffing-box into a glass tube, which had been drawn to an almost capillary orifice at one end, and then filled with mercury, and collecting the displaced globules as the rod was advanced; but considered his own method preferable.

Baron du Mesnil's Safety Lamp.—The Baron Eugene du Mesnil gave a description of a safety-lamp, invented by him in 1834. He stated that he had presented it to the French government in 1837, and that it had been now adopted, after a favourable report upon it by M. Ch. Combes.

This lamp consists of a body of flint glass, defended by a dozen of iron bars. The air is admitted by two conical tubes, inserted at the bottom, which are capped with wire gauze, and enter by the side of the flame. The latter rises into a chimney, which has a piece of metal placed in the form of an arch over its top: the chimney, however, being quite open. The consequence of this construction is, that a strong current is constantly passing up the chimney. When carburetted hydrogen passes in, the fact is discovered by numerous small explosions, and the whole glass work is thrown into vibrations, which emit a loud and shrill sound, which may be heard at a very considerable distance.*

Prof. Graham stated, that the novelty in Baron du Mesnil's lamp was, the circumstance of the chimney being quite open. He considered that the lamp of Davy was left almost perfect by that philosopher, and that all accidents proceeded from carelessness. He alluded to the deleterious effects of the *after-damp*, or carbonic acid left in the atmosphere of a mine after an explosion, which is believed to occasion often greater loss of life among the miners than the original explosion, and often prevented assistance being rendered in case of accidents. In many cases, it was certain that the oxygen of the air was not exhausted by the explosion, although, from the presence of 5 or 10 per cent. of carbonic acid, it was rendered irrespirable. The atmosphere might, therefore, be rendered respirable by withdrawing this carbonic acid, and he suggested a method by which this might be effected. He had found that a mixture of dry slaked

* The Baron has favoured us with drawings and description of his lamp, which we shall take an early opportunity of publishing. Ed. M. M.

lime and pounded Glauber's salts, in equal proportions, has a singular avidity for carbonic acid, and that air might be purified completely from that deleterious gas, by inhaling it through a cushion of not more than an inch in thickness, filled with that mixture, which could be done without difficulty. He suggested the use of an article of this kind by persons who descended into a mine to afford assistance to the sufferers, after an explosion: indeed, wherever the safety-lamp was necessary, and the occurrence of an explosion possible, the possession of this lime-filter would be an additional source of security.

(To be continued.)

NOTES AND NOTICES.

The Thames Tunnel.—On Thursday, Aug. 29th, the workmen employed in this undertaking succeeded in reaching low water-mark, the accomplishment of which task causes all fear of another irruption taking place to become allayed. The length of the tunnel is now 920 feet, being little short of three-quarters of the whole distance which it will be necessary to effect to reach the Middlesex shore, there being about 380 feet more to complete the entire length. The average distance which the workmen weekly accomplish is nine feet; it is therefore expected that the tunnel will be opened for passengers towards the latter end of next year.

Artificial Ivory.—Messrs. Boaden & Co. of Sheffield have just obtained a patent for the making of a substance so nearly resembling ivory, and so applicable to all the purposes of that valuable material, that it is almost impossible to detect the difference. —*Sheffield Iris.*

Purifying Sea Water. — A recent discovery has been made, the results of which will be of immense importance to the shipping interest and, setting aside the question of private profit, will protect our seamen from one of the greatest tortures to which the dangers of the service exposes them. A short account cannot fail to interest our readers. Several tuns of the sea-water have been forwarded under seal, from the port of Havre, for the purpose or testing, on a new principle, the capabilities of its application to domestic use. The first experiment took place in the presence of the directors of the navy, and the result surpassed all expectation. The sea-water, as rectified by the machinery, is as clear and fresh as the water of the Somme. Previous experiment has also demonstrated that its use is equally wholesome. The testing machinery gives employment to 500 men. Here indeed is a great problem solved.—*Inventors' Advocate.*

Official Report on Building Stones.—The inquiry undertaken under the authority of the Lords Commissioners of her Majesty's Treasury, by Charles Barry, Esq., F.R.S. and F.G.S., W. Smith, Esq., D.C.L. and F.G.S., and Mr. C. H. Smith, with reference to the selection of stone for building the new Houses of Parliament, has resulted in a report, which contains many valuable and interesting statements with relation to the different varieties of stone in this country, and also the various influences which affect the durability of edifices. It concludes with the following recommendation:— "Having weighed to the best of our judgment, the evidence in favour of the various building stones which have been brought under consideration, and freely admitting that many sandstones as well as limestones, posses very great advantages as building materials, we feel bound to state that for durability—for crystalline character, combined with a close approach to the equivalent proportions of carbonate of lime and carbonate of magnesia—for uniformity of structure, and facility and economy in conversion, and for advantage of colour, the magnesian limestone, or dolomite, of Bolsover-moor, and its neighbourhood, is, in our opinion, the most fit and proper material to be employed in the proposed new Houses of Parliament."

Important Improvement in Gas Making.—We have been favoured with a view of a most beautiful and ingenious self-acting gas apparatus, patented by Mr. William Holme Heginbotham, of this town, which has been a considerable time in operation at the works of Messrs. John Marsland and Brothers, and gone through a series of experiments, the result of which is highly satisfactory. The retort, which is four feet long, produces upwards of 8,000 feet in 24 hours, being three times as much as can be made upon the present system from our retort. The gas has not only a much greater illuminating power, but is relieved from those impurities which have hitherto prevented the adoption of that most beautiful light in private dwelling-houses, and it extracts one-third more gas from a given quantity of coal. This invention we have no doubt will command the attention of the public generally.—*Stockport Advertiser.*

The Galvanic Telegraph at the Great Western Railway.—The space occupied by the case containing the machinery (which simply stands upon a table, and can be removed at pleasure to any part of the room) is little more than that required for a gentleman's hat-box. The telegraph is worked by merely pressing small brass keys (similar to those on a keyed bugle), which acting (by means of galvanic power) upon various hands placed upon a dial-plate at the other end of the telegraphic line, as far as now opened, point not only to each letter of the alphabet (as each key may be struck or pressed), but the numericals are indicated by the same means, as well as the various points, from a comma to a colon, with notes of admiration and interjection. There is likewise a cross (X) upon the dial, which indicates that when this key is struck, a mistake has been made in some part of the sentence telegraphed, and that an "erasure" is intended. A question—such, for instance, as the following:—"How many passengers started from Drayton by the 10 o'clock train?" and the answer could be transmitted from the *terminus* to Drayton and back in less than two minutes. This was proved on Saturday. This mode of communication is only completed as far as the West Drayton station, which is about 13½ miles from Paddington. There are wires (as may be imagined) communicating with each end, thus far completed, passing through a hollow iron tube, not more than an inch and a-half in diameter, which is fixed about six inches above the ground, running parallel with the railway, and about two or three feet distant from it. It is the intention of the Great Western Railway Company, to carry the tube along the line as fast as completion of the rails takes place, and ultimately throughout the whole distance to Bristol. The machinery and the mode of working it are so exceedingly simple, that a child who could read would (after an hour or two's instruction) be enabled efficiently to transmit and receive information. —*Observer.*

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

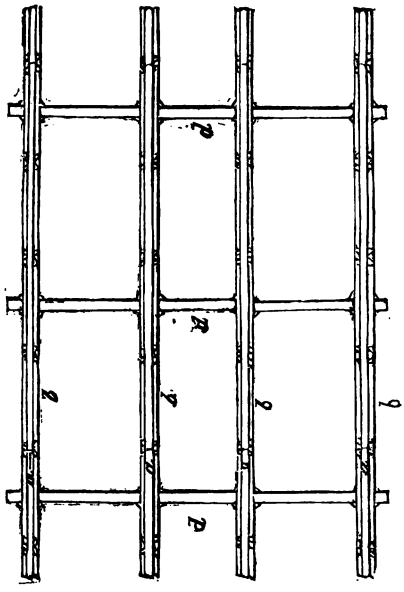
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 840.] SATURDAY, SEPTEMBER 14, 1839. [Price 3*d.*

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

CONTINUOUS ELASTIC RAILWAY.

Fig. 1.



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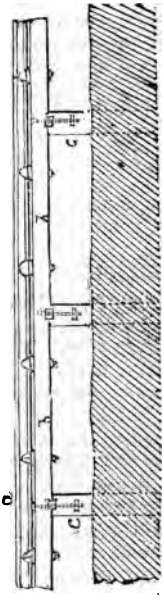
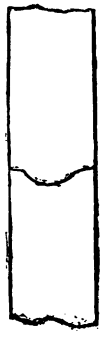


Fig. 4.



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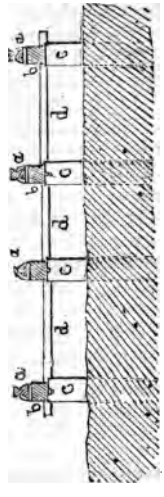

CONTINUOUS ELASTIC RAILWAY.

Sir,—Shortly after the opening of the Liverpool and Manchester railway, I had occasionally to pass along part of that line, and in common with other passengers, I was struck with the disagreeable stunning sensation felt in the carriages, which I could attribute to no other cause than the springing of the rail between the chairs, causing a rapid percussion of the wheels of the carriage upon that part of the rail lying solid upon the chairs. To obviate that real or imaginary defect, I made a sketch of an elastic railway, which I now forward, and if you should think it worthy of a place in your excellent Magazine, it will oblige, Sir, yours, respectfully,

J. + J.

Goodnestone, August 31, 1839.

Description.—Fig. 1 is a plan of the railway; fig. 2, a side view; and fig. 3, a cross section, The iron rails, *a*, rest on chairs, having their base larger than is usually made, so that the pressure may not injure the longitudinal bearers, *b*, to which the chairs are securely fixed by screws. These longitudinal timbers are bolted down to the piles, *c*, the bolts passing through the cross ties *d*. Fig. 4 shows the abutting of the iron rails; from being cut in this manner, they will admit of a considerable opening from contraction in cold weather, or other causes, without affecting the wheels in passing over them. From the chairs resting on the longitudinal timbers, at some distance from their support on the pile, and the iron rail lying hollow over the pile, it is obvious that a continuous elastic rail will be the result, and which of course must be easier for passengers, and much less destructive to the machinery employed.

If the rails were kept about three feet above the surface, there would be no necessity for fencing.

J. + J.

THE "BRITISH QUEEN" AND "GREAT WESTERN."—MR. SAMUEL HALL'S CONDENSERS.

Sir,—Two letters have appeared in your No. 838, one from Mr. S. Hall, and one from a person who appropriates my patronymic, with the addition of "Rod." —*Rod in pickle*, he might have signed himself with more propriety. Both these epistles are written with the intention of inflicting heavy punishment on me for calling the attention of your readers to a passage in the report on steam boilers, &c., of Messrs. Pringle and Parkes, and for asking Mr. S. Hall a question or two upon the subject of his condensers. Both the above champions of the *British Queen* shirk altogether the questions I asked, and fill your pages with a trashy attempt to run down the engines of the *Great Western*, a vessel which, by her good qualities, and the excellence of her engines and boilers, has performed her voyages, both winter and summer, with a regularity, certainty, and speed, beyond all precedent, and has earned a reputation for the makers of her engines that not all the sneers and scoffs of Mr. S. Hall and "Piston Rod" can for a moment injure.

I can only say that these two worthies are out at all points; the respectable firm against whom their powerless, but malignant, sneers seem to be directed, knows nothing whatever of "Piston," nor can "Piston" claim the honour of any knowledge of "Observator," although it is evident by his writings that he is a clever well informed man, and well calculated to support the reputation of your valuable journal.

As in England we do not consider it fair for one to be engaged with two antagonists at a time, I purpose encountering these two worthies *seriatim*, or, as the schoolboys word it, "one down and 'tother come on;" and I think that I shall be able to manage them both, notwithstanding the awful announcement that "Piston Rod" intends to inflict more punishment, and that perhaps, too, in his real name. I have decided to begin with Mr. H., as he is undoubtedly entitled to the first chance of the benefits this correspondence may bring.

Mr. Hall wastes an entire column in picking up morsels of comfort from that part of my letter where, in allusion to the *India*, I state that his condensers may make a vacuum of 29 inches or 29½ inches. He is evidently so delighted with them, that it is with great reluctance he comes to the question—why the "*pure distilled water*" was not maintained at its proper level? Then, notwithstand-

ing his beautiful letter about the performance of the condensers in the *British Queen* in your former number of July 13th, he leaks out the important fact, that her engines are also supplied with *common injection condensers*, that these condensers were used, and that the boilers were blown out too low *by design*.

Why, Mr. Editor, is it possible that having Mr. Hall's superlative condensers on board this ship, that the engineers and owners, who were on board during the voyage round, aye, and Mr. Hall there too, should use the common condensers (which send the dirty salt water into the boilers), instead of the patent ones, which Mr. H.'s previous letter stated were used. I ask, Mr. H. what are the public to infer from the above, but that these engines required the common condensers to work them, and that salt water entered the boilers, and that the boilers were blown out in the ordinary way. What, therefore becomes of Mr. Hall's puff, and how can he, after this, send the amazingly long list of advantages, which he has done at the end of his letter, by way of answer to me. The fact is, that had the *British Queen* been supplied with the patent condensers only, she might have been yet struggling on her first voyage against the waves of the ocean. It is notorious that the common condensers were used out and home; and the Directors of the company may, therefore, "congratulate themselves" that they had foresight enough to have the engines of this ship so fitted.

I had almost forgotten to observe that to my inquiry as to the purport of a gang of Messrs. Rennie's workmen being sent on board the *British Queen*, Mr. H. replies with characteristic perspicuity, that it was *simply because Messrs. R. were gentlemen*. Your readers I am sure must think with me that this is a most novel and extraordinary method of testifying esteem for one's friends; and I think to carry out the example he has shown with impartiality, Mr. H. is in duty bound to perform the same courtesy to all those gentlemen engineers whose names he enumerates in his last letter; in fact all the *gentlemen* in London have a fair right to expect cards of invitation for their servants on the same peculiar and profitable principle.

Mr. Hall winds up his letter with an advertisement of 10 different advantages to be gained by the use of his condensers. As there are some others which he has forgotten to point out, I will just send them by way of addenda, for the benefit of your readers—taking up the enumeration where Mr. H. left off.

11. An increase in the cost of the engines of about 15 per cent., on account of the quantity of extra work required.

12. Another increase of about 10 per cent. (a mere trifle), to pay me for my patent right.

13. An addition to the complexity of the engines of two miles of copper pipe, or in number, for 200 horses power, say 5,000; of immense cold water pumps, to drive cold water through and about the pipes (while in the common engines it runs in the condensers by a small pipe of its own accord); and of stills placed inside the boilers, with all sorts of still apparatus, which must be almost constantly at work, to replace the leakage and loss of the fresh water (*i. e.* to keep the *pure distilled water* up to its proper level), without which the boilers would be burnt.

14. Of the multiplication of cocks and pipes in the engine room, to such an extent that a previous six months' education at Basford is necessary to enable the engine men to comprehend their nature and working.

15. The amusement to the engine men, from the necessity of periodically scrubbing and washing out said 5,000 pipes with alkali, soap suds, ramrods, sponges, &c., &c., of the scum and filth that accumulates both within and without them.

16. An increase of weight of all these articles and traps on board of a steam packet, as also the additional weight of water in his condensers, and cold water pumps; being three times as great as the weight of water in the condensers of the common engines.

17. The great advantage in the economical generation steam, when it is considered that Mr. H., to get his vacuum, cools down the feed or supply-water to the boilers, to about 50° or 60° while in the common engines, the feed-water generally goes in at about 90° or 100°, from which one must perceive the advantages he gains in economy of fuel!

I might go on, Mr. Editor, adding to

the above list of advantages, but I think for the present this will do, to let Mr. H. see that the public are beginning to appreciate his plans, and can even discern *advantages*, which he, poor man, has suffered to escape him.

I am, Sir, your obedient servant,

PISTON.

ON AEROSTATION.—MR. WEEKES IN REPLY TO TANGAR.

Sir,—Owing to my local position not affording the means of procuring the periodical literature of our metropolitan press oftener than once a month, I had not the pleasure of meeting with the notice by which you have honoured my "suggestions" on aerostation, until the present moment, or, I assure you I feel that the science, candour, and evident desire to arrive at truth, which your communication evinces, would have rendered a reply from me incumbent at an earlier period.

Permit me, in the first place, to remind you (see page 291) that my remarks are to be regarded generally as *suggestions*, and "in such light only I would by that they may be received;" and again, (see page 294) in reference especially to the suggested improvement in balloons, I submit my observations as "*scantlings* of a plan for an aerostatic machine," &c.; and I have now too much cause to fear that even these "scantlings" have been so imperfectly rendered, that though the details were obvious enough in the pictures of my own imagination, they are by no means conveyed with that definite degree of expression essential to the comprehension of others, who cannot be supposed on familiar terms with my own ideas.

I must at once acknowledge the validity of your remark, that a pipe two inches in diameter, and offering a surface of only about 6¼ inches top and bottom, would be inadequate to the secure attachment of any species of texture composing the material of the balloon. In regard to the diameter of the pipe, or *tubular mast*, my idea was that it should taper regularly from its base to its apex; and, therefore, it would necessarily be somewhat larger at the bottom than at the zenith of the balloon, and I should also have chosen a larger pipe than you have supposed for the occasion. However, all this, I believe with you, would fall short of the purpose in view, were it not that if I could *attempt* a practical illustration of my suggestions, I designed to surround the copper tube at the two points of union with the *balloon proper*, by two several discs of wood, their surfaces being concave within, and of an opposite character without; for example, similar to the arctic and antarctic regions of the artificial globe. Each of these I would have not less than from two to three feet in diameter, of proportionate thickness, and grooved around their peripheries, in order to effect a better means of junction with the material of the balloon. Thus, instead of a surface of 6¼ inches top and bottom, I should acquire upon the whole not less than from 12 to 18 feet of linear surface for the attachment of my material, and this, perhaps, you will concur with me, might prevent the balloon being torn from the pipe by the ascensional force of a required volume of gas. You will, probably, say I ought to have shown this in my illustrative sketch, or to have detailed the intention at length in the text, and I must admit that *I* think so too.

Secondly, Sir, I find your calculations perfectly correct, upon the supposition of a balloon 40 feet in diameter ascending to an altitude of 9,000 feet, provided that the balloon were inflated to the extent of its capacity at the moment of quitting the earth's surface. But I believe it is the practice with aeronauts in ordinary to inflate their balloon very little beyond one half of its cubic capacity, in order to meet the exigencies of an increase in volume when they arrive in the higher regions of the atmosphere. Such a view of the subject, if not expressed, was, at least, entertained in my own mind, when the "estimate was founded on an assumed balloon of 40 feet diameter," though, I should observe, that my calculation here alluded to, was not intended expressly to apply to my "suggested improvement," but illustrative rather of the principle upon which that was supposed to be formed. This explanation, Sir, I trust, may considerably modify, if not remove, your second objection.

Throughout the paper to which you

have obligingly recalled my attention, I may say, that my mind was principally intent upon *travelling* by means of balloons, and the intention of ascending to great altitudes was secondary only in my consideration; and I should imagine that for all useful purposes of the aerial *traveller*, an altitude of one mile, or occasionally a little more, would be amply sufficient.

My greatest degree of doubt, as to the success of these projects, obtains, when I reflect upon the means and power requisite to condense the necessary volume of hodrogen into the copper reservoir to answer the purpose designed. However, difficulties as great, if not greater, perhaps, have been overcome, and, surely, he may reasonably venture to hope that these will ultimately vanish before the united efforts of genius and perseverance.

In conclusion, Sir, I fear you will, notwithstanding the explanations I have offered, still find ground for apparent, if not real, objections to my plans, any of which it would rather give me pleasure than otherwise, to have pointed out and (if possibly) removed; though I can hardly hope that my present engagements will afford me the requisite time for such a purpose, considering, as I do, the subject yet in its infancy, and my object purely, the hope of its advancement.

I am, Sir,
With much esteem, yours,
W. H. WEEKES.

Sandwich, September 3, 1839.

MOVEABLE SAFES.

Sir,—I saw a paragraph in your valuable Magazine, of August 17th, copied from the *Manchester Chronicle*, stating that, Messrs. Chubb and Son, the lockmakers, had invented a machine for raising an iron safe, out of the well in which it is placed; and that one man could, with the aid of this machine, raise a safe two tons weight, 15 feet high, in five minutes. Now I think this is all nonsense, and I will tell you why.

Bolton and Watt, and many other eminent engineers, calculate that 1-horse power, will raise 32,000lbs. 1 foot high, in 1 minute; and mechanics generally agree, that 5 men, are equal in power to 1 horse; there are 4,480lbs. in 2 tons, and (according to the *Chronicle*) 1 man can raise with this machine, 4,480lbs. 15 feet, in 5 minutes, or 3 feet in 1 minute; or which is the same thing, he can raise 13,440lbs. 1 foot, in 1 minute. But $\frac{1}{2}$th of 32,000lbs. is only 64,000lbs., which, according to the Bolton and Watt calculation, is the weight which 1 man can raise 1 foot in 1 minute; and if we divide 13,440 by 6,400, we shall find, that through the aid of this wonderful machine, the power of 1 man will be increased, in the ratio of 2.1 to 1; Now if the Editor of the *Chronicle*, saw this machine, he either knows little, or nothing, about mechanics, or else has this opinion of his readers; for according to his statement, if this machine be attached to a 10-horse engine, it will do the work of a 21-horse engine. It is quite ridiculous to dwell on such stuff, and I will therefore say no more about this part of the question.

The *Chronicle* also states, that the apparatus, which have been used, for the purpose of raising safes, have been found so expensive, complex, and liable to get out of repair, that they are very seldom used. As to the expense of machinery, every person knows what that is, who has to purchase it; but I will show you, that the machinery which has been in use for several years, in this town, is not so complex, as the *Chronicle* imagines. There is in this town, a building, where large sums of money are deposited; in a corner of this building, there is a room about 6 feet square, inside measure, built of large blocks of stone, about 2 feet thick, and it has a strong iron door, at the entrance; the top of which door, is about 9 feet from the top of the room, which is about 30 feet deep from the top to the floor; in this room there is an iron safe, having a door in the side, to coincide with the door in the wall, when the safe is raised up; but when it is lowered down, there is a space of only about 2 inches, between it and the wall, so that it is impossible to get to the door, while the safe is down. Now this safe is raised on the same principles as the hydraulic press, (which I have no doubt your readers are so well acquainted with, that I need not explain it here;) in the centre of the bottom of the

room there is placed the cylinder, in which the ram works, the top of the ram, is attached to the bottom of the safe, the pipe from the cylinder to the pump passes through the wall, and it might be carried to any convenient distance, either inside, or outside the building, so that it is not necessary to have the pump in the building or even near it, if the pipe is kept air-tight.

I dare say you are well aware that the power, or rather mechanical advantage, which may be gained by the hydraulic press, is almost boundless; for a press with a 4-inch ram, (which is the smallest size generally made) and a 1 inch pump; having a lever to work it 5 feet long, attached to the pump 3 inches from the fulcrum, will, with a pressure of 140lbs. on the end of the lever, raise 4,900lbs., so that 1 man, would be able with a machine of these dimensions, to raise 2 tons easily. I do not mean to say, he could raise it 15 feet in five minutes, but he could raise it in as short a time, and with as little exertion, as with any machine, which Messrs. Chubb have invented, or may invent.

I remain, yours respectfully,

TANGAR.

Manchester, August 30, 1839.

SOLUTION OF THE SECOND PUMPING QUESTION.

Sir,—I send you a solution of the 2d Cambridge Pumping Question proposed by a Westminster Scholar.

I am, Sir,

Your obedient servant,

JOHN NELSON.

19, Paddington-street, August 31, 1839.

Solution.— $\frac{3}{2} \times \frac{4}{5} = 1\frac{1}{5}$: that is, the effect produced by A in any given time is $1\frac{1}{5}$ of that produced by B in the same time. First, suppose, A can pump $6x$ gallons in one hour, then B can effect $5x$ gallons in the same time, also let y be the horary influx, and Z the time that A worked $\therefore 13\frac{1}{3} - Z =$ Time B wrought; consequently, $6xz$ is the whole number of gallons pumped by A; and $(13\frac{1}{3}-Z)\ 5x = \frac{200x}{3} - 5xz$, number of gallons pumped by B, $\therefore$ therefore $\frac{200x}{3} + xz =$ gallons pumped by both, and $13\frac{1}{3} \times y = \frac{40y}{3}$ whole leakage, $\therefore$ $\frac{200x}{3} + xz - \frac{40y}{3}$ is the gals. in the hold at first. Also $(6x + 5x) \times 3\frac{3}{4} = \frac{165x}{4}$ gallons A and B pumped together, and $3\frac{3}{4}y = \frac{15y}{4}$ is the leakage in the same time, $\therefore \frac{165x-15y}{4}$ is another expression for the number of gallons in the hold at first, $\therefore$ $\frac{200x}{3} + xz - \frac{40y}{3} = \frac{165x-15y}{4}$, from which equation we obtain $Z = \frac{115y-305x}{12x}$; also $\frac{15}{4} \times 6x = \frac{90x}{4}$ gallons pumped by A along with B $\therefore$ $\frac{90x}{4} = 6xz + 100$ $\because Z = \frac{45x-200}{12x} = \frac{115y-305x}{12x}$; hence, $y = \frac{70x-40}{23}$. Again, had A worked as long as B, then $\left(\frac{40-3z}{3}\right) 6x$ would be the gallons he would have pumped in that time, and $\left(\frac{40-3z}{3}\right) y =$ leakage for the same time, $\therefore \left(\frac{40-3z}{3}\right) 6x - \left(\frac{40-3z}{3}\right) y$ will be a third expression for the number of gallons in the hold at first $\therefore$ $\left(\frac{40-3z}{3}\right) 6x - \left(\frac{40-3z}{3}\right) y = \frac{165x-15y}{4}$, from which equation we find $Z = \frac{465x-115y}{72x-12y} = \frac{115y-305x}{12x}$. And this equation by reduction, becomes $y^2 - \frac{222xy}{23} = \frac{459x^2}{23}$. Solving this quadratic, we obtain $y = 3x$ $\frac{70x-40}{23}$

$\therefore x = 40$
and $6x = 240$ gallons pumped per hour by A,
and $5x = 200$ ——————————— B,
and $y = 3x = 120$ gallons the horary influx,
and $\frac{165x - 15y}{4} = \frac{6600 - 1800}{4} = 1200$ gallons in the hold at first.

J. N.

COLLEGE FOR CIVIL ENGINEERS.

We copy the following statement of the objects and plan of this newly-projected college from the prospectus of its promoters. No doubt an establishment of this sort is greatly wanted, and if well organised and managed, must succeed; but the present project seems to us rather a crude and ill-digested affair, with a host of distinguished patrons, but a very feeble direction.

Objects.—Since England has become the chief manufacturing kingdom of the world, a demand for efficient practitioners in civil engineering has gradually increased, but which demand has not been adequately supplied. Not one of our Universities or public seminaries has kept pace with this want of the age, and afforded a suitable education for the aspirants in that new profession. It is manifest that those men who are to direct the practical application of those arts and sciences on which the efficiency of our machinery depends, should be thoroughly grounded in natural philosophy in all its branches, and in the collateral knowledge of those subjects which are necessary adjuncts. They are in a great measure responsible for the profits on our internal industry—on the average of which depend agricultural returns, and also, by reaction, an increased demand for labour. To the civil engineer the public looks for safety and stability in the structure of railways—the capacity and strength of our canals—the clearing and improving of our navigable rivers—the construction of our docks, and the rendering our harbours secure from the effects of winds and waves. On him depends the clearing of mines of water, and their necessary ventilation; to him his country looks for simplifying the means, rendering safe, and accelerating, the transit of the world; and lastly, on his ability we rely for the correct and economical expenditure of much of the available wealth of the realm, which, when thus used, like the seeds of the earth, increases and facilitates further production.

Hence the national importance of the profession of the civil engineer is obvious; and this being admitted, it is manifest that an exclusive system of education should be sedulously pursued by those on whom such great responsibilities are imposed. The object of this institution is to afford the means of pursuing such an education, and, by combining theory and practice, to keep pace with the continual and rapid advances in the boundless fields of practical invention and of scientific discovery.

The course of instruction, as afterwards laid down, has been submitted to most competent judges, who have given to it their unqualified approbation.

With a view of raising a fund to meet the large outlay consequent upon the first establishment, peculiar advantages are offered to those who are willing to promote the undertaking by their contributions.

A graduated scale enables the provident parent, by the payment of small instalments during infancy, to ensure the education of his son in accordance with the course laid down, and in case of death, and in other cases more particularly specified therein, to have the money he has advanced equitably returned.

As there may be many to whom the whole course would be unnecessary, but who may be desirous of studying certain branches, each branch of the course will be open to students under certain regulations.

An evening class will also be opened, for the purpose of giving to the *working engineer* theoretical instruction, applicable to practical knowledge.

Course of Instruction.—The college is divided into—1, a High School; and—2, a Workman's Class.

There are to be professorships of mathematics, descriptive geometry, mechanics, steam engines; drawing:—architectural, topographical, mechanical, and ornamental; hydrography and land and water transport, architecture and general construction, naval architecture, physics, chemistry, metallurgy, mineralogy and geology, mining, laws of property, geography, statistics, history, English language and literature, French ditto, German ditto, Latin and Greek Languages, and *one of the professorships is to be entrusted to a Clergyman of the Church of England.**

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* The *italics* are after the original.

High School.—Age of Admission, from 14 *years. Course of* 5 *years.*—The college is to be based upon the principles of the Established Church. But such pupils as are of a different religious persuasion are to be permitted to have free communication with their pastors, and to attend their respective places of divine worship; the moral habits of all the students are to be strictly attended to and enforced.

Diplomas are to be granted to those who shall have satisfactorily completed the whole course; and certificates of competency to those who may have qualified themselves in any particular branch or branches.

To the first hundred pupils whose names are registered as boarders, the charge for board and education during the first two years is to be 100*l.* per annum. After that period the charge to such first hundred pupils will be increased 20*l.* per annum. When the number of 100 pupils is completed, the charge to all boarders entering subsequently will be 130*l.* per annum. Those sums will include all the expenses incidental to sickness. The charge for education to the daily pupils is 100*l.* per annum.

Workman's Class.—Age of Admission, from 16 *years.—Terms,* 3*l. per quarter.*—The age of admission to the workman's class is from 16 years upwards.

Candidates for admission to the workman's class will be required to produce certificates of health, and of good conduct, and must be able to read and write.

Those who go through the whole course may have the benefit of an examination, which will be conducted in a strict and impartial manner.

Certificates of ability will be given to those who shall pass satisfactory examinations.

Fund and Contributions.—It is proposed to raise a fund to meet the large outlay consequent upon the first establishment of this Institution, by Contributions.

The Contributors are divided into classes, and to each class are attached certain privileges

Library and Museum.—A library of scientific works, and a museum of models, implements, tools, drawings, materials, &c., for the use of the students, and also a laboratory and workshops, will form part of the establishment.

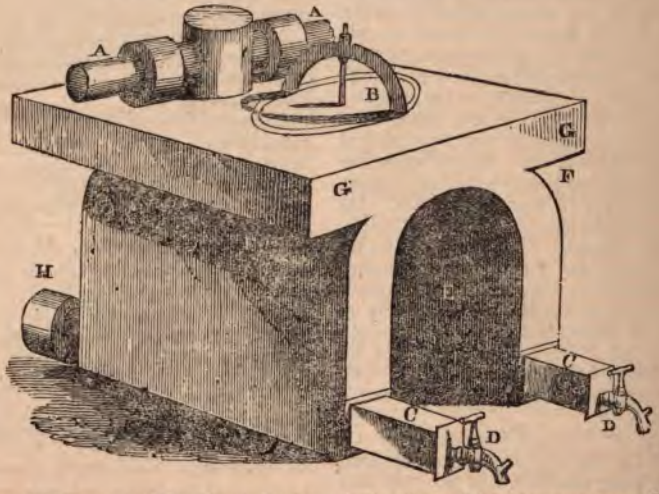
With the sanction of the council, admission to the library and museum will be granted on the annual payment of two guineas.

On the payment of ten guineas in one sum, the council have the power of granting admission to the library and museum during the life of the contributor.

On the payment of twenty guineas in one sum, the council have the power of granting admission to the library and museum during the life of the contributor, with the additional privilege of introducing two visitors daily, for whom he will be held responsible.

The council are to open the college so soon as they consider that the fundamental objects are obtained.

WILLIAMS'S PATENT HOT-HOUSE BOILER.



Messrs. Williams and Co. have lately *patented a wrought-iron* boiler, particularly adapted for the purposes of heating with hot water, churches, public build-

ing, greenhouses, conservatories and private houses and apartments. We have been informed that it has been very extensively adopted, and the certificates which have been given by those who have used it are very favourable, as regards the economy of fuel, and the ease with which it is cleaned out. It also appears that small coke or good cinders are preferable to coals as fuel for feeding this boiler.

In the annexed perspective view, A A, are the flow pipes, B, the manhole. C C, are projecting additions for the purpose of cleaning out the dirt from the inside and bottom of the boiler; these projections are nine inches long and three inches square, with cocks D D, fixed on the front with moveable flanges. E, is the fire-place. F, the outside of the boiler, forming the side-flue in which the fire passes round. G G, the top of the boiler, which projects five inches from the sides of the boiler, and serves as a cover to the flue. It is three inches in depth and is kept filled with water. H, is the return- pipe.

The whole of this boiler is made of wrought-iron.

ENGINEERING—JAMES WATT—MR. NAPIER OF GLASGOW.

(From the Dumfries Courier.)

There is, perhaps, no department of art in which Great Britain stands more proudly pre-eminent than in engineering skill and capability, whether as applicable to the manufacture of machinery, or the formation of those splendid *vias*, unknown alike to Greek and Roman fame, which, by sheathing the solid earth with iron, are revolutionising rapidly its nether crust, and will continue to do so more and more, in every division of the habitable globe. Canals at one time were exceedingly useful, and are so in various instances still; and there was something originally bold in the idea of lifting water from planes to heights, by means of locks connectedly linked according to distance, so as to enable vessels of varied build to ascend the sides of sharp acclivities—mounting step by step through congeried openings that well deserve the name of "Neptune's Ladder." Old Brindley was no doubt a wonderful man, but James Watt a greater still, and hence the fading lustre of locked canals, compared to railroads locomotives, viaducts, tunnels, wheels worked by endless rope, with minor devices not a few, the staple, so to speak, of modern engineering. The fabled Cyclops that derned amidst the bowels of Mount Etna, were nothing to the artists located near Birmingham, and lever Archimedian, "fit to raise the globe," unaided by the fulcrum it must ever lack, a mere distaff when put in competion with the all-conquering power of steam, "a power which can engrave seals, and crush masses of the most obdurate matter; draw out, without breaking, threads as fine as gossamer, and lift ships of war like a bauble in the air; embrodeir muslin, and forge anchors; cut steel into ribbands, and impel loaded vessels against the fury of the winds and waves." Of practical benefactors of the human race, the improver or rather inventor of the steam engine, was unquestionably the greatest that ever existed; and it is delightful to find M. Arago himself, a great master of Physics, taking this elevated view of his character. But skilful as Messrs. Watt and Bolton were, they have found worthy successors; and of these there are few, if any, more distinguished in his own department, than the gentleman whose name stands at the head of this article—Mr. Napier of Glasgow. His extensive workshops are quite a study, in which persons moderately curious might spend with growing interest and pleasure, the longest summer's day. When on the Clyde lately, my own steps were directed thither, and high as my anticipations previously were, I found expectation so far eclipsed by sober reality, that I will be irresistibly drawn the same road, should ever an opportunity occur again. Mr. Napier employs seven hundred men, and as one of his people quaintly remarked, could raise, were it war time, with the greatest ease, a well-appointed regiment from resources plentifully scattered over his own premises. Nor would it be easy to imagine a corps more thoroughly able-bodied, powerful of arm, strong of wind, and every way sound of lith and limb. But there are various ways of fighting the battles of one's country, and what method more direct and patent than manufacturing the propelling power of vessels of war? Even the wages paid by Mr. Napier exceed in value, during the year, the rent-roll of some of our richest noblemen, to say nothing of the materials he so abundantly consumes. The rural world in sequestered retirement may wot little of the high pressure enterprise that gladdens the commercial, keeping it constantly buoyant like the ocean it bridges, scattering afar the blessings of interchange, and along with these, shedding peace and plenty round the homes and hearths of millions of industrious artisans. There were cities of old whose merchants were princes;

and there are localities similarly enfranchised still. In first class engineers, spinners, manufacturers, iron masters, calico-printers, &c., we find many examples, and I could name a British merchant, not connected with the port of London, who has 64 fine vessels engaged in the foreign trade, that traverse every sea; three hundred carpenters constantly building new or repairing old; and who perhaps turns over annually a larger amount of money than is deposited at present in the specie coffers of the Bank of England.

In point of mould the *British Queen* is supposed to be the most beautiful vessel now afloat; and although her timbers were fashioned on the Thames, her iron fittings were fabricated at Glasgow, one of the highest compliments that could possibly be paid to the engineer capabilities of the Clyde. Mr. Napier at that time had no wet dock connected with his foundry and other works, and from that desideratum was under the necessity of sending the *Queen* to Port Glasgow; but he will soon be independent in this respect, for on the 24th ultimo, I found Mr. Robinson, the well-known builder, busy preparing one, which perhaps ere now has become the temporary berth of a British frigate. In addition to private, Government orders are flowing upon Mr. Napier—testimonials, it will be admitted, of the most pleasing character—and I had the pleasure of inspecting two double engines, each of the power of 320 horses, which are to be put on board Government frigates, already launched, and which, when finished, will form new and splendid feathers in the cap of the British Navy. In guessing the price of one of those sets at five thousand pounds sterling, my ignorance received a severe rebuke in the announcement that such a sum would not cover the men's wages; and perhaps fifteen thousand pounds or guineas come much nearer the proper mark. Workmanship more beautifully polished and true, it is impossible to imagine; nor is ponderosity awanting; for I was told that one of the sets would weigh 150 tons without, and 350 tons with the boilers. The air-pumps of these splendid frigate steamers in place of being lined with, are formed of solid brass, which, even in its polished state, weighs thirty-five cwt.; and this valuable metal, on any thing like the same scale, was never cast in Glasgow before. But powerful as these engines are, I saw one in progress which is to be a half larger—another Government order for a ship called the *Halifax*—which is to convey the mails between London and America. The inside of the cylinder weighs eight tons, but its dimensions as well as weight are very great; and I was informed that when the *Commodore* "Liner" to Liverpool, was being fitted at the Napier wharf, two of these huge vessels, on being placed together, afforded excellent dining-room accommodation for a party of twenty-one gentlemen. That the meeting was a right merry one cannot be doubted, and champagne bumpers not a few were dedicated to the success of, and health and happiness of all connected with, a most splendid steam ship, with cabins adorned in ducal style, in which large parties dine every day of the year—an inn, in short, afloat, with banquet boards rich in every luxury that rank can covet, or wealth command.

Mr. Napier's smithy forms a sight of itself; and it was curious to see coal fanned into flame, not by the bellows, but by what is far steadier, atmospheric air, filched from the sky, and forced through pipes by means of a wheel. The foundry is at times a fearful place; molten iron or lead is to the full as formidable as the lava's breath, and still more extraordinary, in appearance at least, fluidity in brass. But the compartments devoted to the turning of the metals—lathes from which tons are slung; others self-acting, deftly performing the most delicate operations, excite even keener curiosity. The whole machinery put in motion is driven by steam; and there can be few spectacles more sublime than that of beholding one powerful engine acting as the principal instrument in fabricating others, and thus proudly, albeit unconsciously, extending the sphere of its own triumphs—territory physical fraught with final results, far beyond any thing minds, the most speculative, have as yet conceived.

SELECTIONS FROM THE PROCEEDINGS OF THE BRITISH ASSOCIATION—NINTH MEETING—AT BIRMINGHAM.

[*Continued from page* 432.]

On paving Roads and Streets with Blocks of Wood placed end upwards.—Mr. John Isaac Hawkins read the following paper upon this subject. The public attention *being turned to* the subject of paving *roads and streets with* blocks of wood placed with the grain in vertical position, the plan being highly spoken of for goodness and durability by many travellers who have seen such roads abroad, and although seven patents have been taken out in England for wooden pavements in little more

than a year past, there still being, I apprehend, no specimen in this country calculated to afford the means of forming a sound public opinion on this most valuable means of road-making: it is desirable that those who have had opportunities of examining such pavements, should contribute the results of their observations and enquiries towards informing the public mind, and to guard it from being led to an unfavourable conclusion, by two specimens very imperfectly laid down in London, one in Oxford-street, and the other in the Old Bailey.

Having myself attentively watched for about four years, from 1827 to 1831, the effect of much travelling over a piece of wooden pavement, well executed, in the principal thoroughfare of Vienna, and observed that it appeared to wear away less than any other kind of paving material whatever; I frequently, after my return to England, in 1831, mentioned to our engineers the superiority of such roadways for carriages, and recommended their universal adoption: having also made inquiries of several persons who have observed the condition of a piece of wooden pavement, laid, about three years ago, in that very great thoroughfare, the Broadway in New York, and been repeatedly informed that the execution of that piece was performed in a workmanlike manner, the particulars of which have been stated to me, I am strengthened in my high estimate of the value of great attention to the goodness of the workmanship. One gentleman of acute observation informed me that he saw a stone of near 20 tons weight drawn in a carriage over this piece of pavement without appearing to make the least impression on it.

Under these circumstances I come forward as a disinterested advocate of this system of paving, under the full persuasion, that sound wood, with the grain vertical, is the best material yet discovered for making good and durable roadways, and that roads formed of that material well executed, may be made so even, as to constitute a sort of universal railway, on which carriages may be drawn by a small proportion of horse-power, and on which steam carriages may be run as safely and almost as fast as on railways.

Thus finding myself in possession of valuable information and experience on this most economical kind of pavement, and having no connection with any parties for carrying it into effect, I deem the Mechanical Section of the British Association the medium by which the public mind can be the most extensively informed, and therefore feel it my duty in a concise manner, to state the points on which the goodness and durability of such roads will mainly depend, They are:—

1. That the wood be chosen from the heart of sound trees, not a particle of sap being in any case allowed to be laid down, lest early rottenness be the result.

The resinous firs offer excellent materials at moderate prices, where but little land carriage is required; but such durable woods may be employed as can be the easiest procured in the respective localities of the roads to be paved.

2. That the blocks which are to be laid contiguously, be cut to an exact gauge, so as to fit closely and evenly together, and when placed side by side on a level floor, no block shall be visibly higher than another.

3. That the depth of the blocks be at least once and a half of the breadth; a firm lateral support being found necessary to stability: twice the depth of the breadth, is to be preferred, each block when rectangular, is supported by four others, and when formed into hexagonal prisms, which appears to be the favourite form, each block is supported by the six surrounding ones, and this support will be the more effective in proportion to the accurate and tight fitting of the whole mass of blocks.

The hexagonal prism being found to afford the greatest quantity of wood from a tree, when the diameter of the prism is as large as can be cut out of the whole diameter of the sound part of the tree, that figure has been adopted in all cases which I have seen seen or heard of, as hitherto carried into effect; I shall therefore omit considering various other figures proposed, until specimens of them have been laid down and fairly tested by experience.

4. That the blocks be laid upon a bed firmly made with gravel, shingle, hard rubbish or other hard material well rammed down, and made even previously to laying the blocks; an excellent bed in New York was made of marble chippings from a neighbouring statuary's yard.

5. That a thin layer of only half an inch of fine gravel be spread evenly over the rammed and levelled surface of the bed, at the time of laying the blocks, to favour their adjustment.

6. That the blocks be laid so as to present an even upper surface before any ramming of them is commenced, in order that the ultimate making them even shall not depend so much on the rammer as on the evenness of the bed, the use of the rammer being to settle the whole firmly down; no block should have to be rammed much more than the rest. If one block be allowed to remain higher or lower than the contiguous ones, a jolting of the carriages will take place, and the tendency of this jolting is to press the lower blocks more than the higher

ones, and thus the evil, when commenced in the smallest degree, is found to be gradually growing worse, for the carriage wheel, when descending from the higher block upon the lower one acts as a rammer, but when ascending from the lower to the higher, it acts only as so much dead weight.

In addition to the above essential points, it may be observed, that the blocks should be cut from dry wood, and used soon after being cut, lest their figure vary by warping. They may be roughly cut abroad, while the tree is green, and re-cut after they have become dry.

The blocks may perhaps be cut by steam-power in England, at as little expence as by hand in foreign countries where, from lowness of wages, it might be supposed England could not compete with them.

Proportion of Power to Tonnage on Steam Vessels.—Mr. Scott Russell read a paper upon this subject. It is a subject of anxious inquiry with every proprietor and constructor of steam vessels, when about to construct a new steam vessel for a given station, What is the best amount of power to place in my ship, so as to accomplish in the highest degree economy, rapidity, and regularity? The inquiry is one accompanied with difficulties. If, on the one hand, a large cargo is desired, which is generally the case, the power of the engine is made small, for the purpose of occupying small bulk, and consuming little coal; and although less velocity is then acquired than with greater power, still less fuel is consumed with a small engine than a large one, and thus it is supposed that greater economy is effected. This maxim, of a small proportion of power to tonnage, is one on which many companies have long continued to act. In other cases, where velocity is absolutely required, a much larger proportion of power has been employed, and, of course, by a large power there is a much greater consumption of fuel than a small one in a given time; and not only so, but it is well known that this additional consumption is much greater than in the proportion of the velocity gained; so much so, that a consumption of four times as much fuel will not give more than about double the velocity. Thus, it has appeared that the use of very great powers, and great expenditure of fuel, has been made with only a very slight increase of velocity. All this, the usual reasoning on the subject, goes to prove the value of employing a small proportion of power to tonnage for economy. The advantage of low powers and of low velocities, in point of economy, would thus appear to be established; but this apparent advantage in theory has not been realized; on the contrary, it may be recollected, *that at the Bristol* Meeting of the Association, Dr. Lardner remarked, that in a case which had come under his own knowledge, where the power had become gradually increased in the same vessel, and it was found that while the vessel was increased in speed, the consumption of fuel on the whole had diminished. This was a fact which Dr. Lardner attributed to Mr. Russell's Wave principle. Mr. Russell had himself attributed it at that time to the same cause, but he had afterwards considered the subject worthy of further examination. He examined the books of the expenditure of fuel in the steam vessels of several companies, and found that they were aware that they had, on the whole, saved money by using high powers of steam and high velocities, instead of low ones. This result he would not in the circumstances attribute to his wave principle; and he had, therefore, examined it carefully, and had arrived at a very remarkable general result, which appeared to him quite new, and to be of very great value at the present moment, when such important interests were involved in the successful extension of deep sea navigation. The general principle at which Mr. Russell had arrived, was this:—*That in a voyage by a steam vessel in the open sea, exposed, of course, to adverse winds, there is a certain high velocity and high portion of power, which may be accomplished with less expenditure of fuel and of room, than at a lower speed with less power.* This principle he then proceeded to prove, and to illustrate by the following case, in which the same vessel is taken with different powers of engine, and the result, as regards expenditure of fuel, determined first arithmetically, and then by a general formula, which will enable any one to determine any particular case.

Fair Weather.

1,200 tons, 400 horse-power, 9 miles an hour, 216 miles per day, 1 ton of coals per hour.—2,160 miles in 10 days, 240 tons of coal.

1,200 tons, 500 horse-power, 10 miles an hour, 240 miles per day, 1¼ ton of coal per hour.—2,160 miles in 9 days, 270 tons of coal.

Adverse Weather.

1,200 tons, 400 horse-power, 5 miles per hour, 120 miles per day, 1 ton of coals per hour.—2,160 miles in 18 days, 436 tons of coal.

1,200 tons, 500 horse-power, 6¾ miles per hour, 162 miles per day, 1¼ ton of coals per hour.—2,160 miles in 13 1-5th days, 395 tons of coal.

General Formula.—Let v represent the velocity of a given steam vessel in a favourable voyage; v' the same vessel in an unfavourable voyage; v'' a vessel, higher power, favourable voyage; v''' unfavourable voyage; p the power of the former vessel; p' latter vessel:—

$$\therefore \sqrt{v''' - (v - v')} = v''' = \sqrt{v}\sqrt{\frac{p'}{p} - (v - v')}$$

$$\frac{p'}{p} = \frac{\sqrt{v''' - (v - v')}}{v'}$$

in the case of equal expense, whence the highest proportion of power that will be economical in fuel may be at once obtained.

Dr. Lardner remarked that the theory of Mr. Russell was quite new to him; but, after the exposition which he had heard, he was satisfied of its accuracy—Mr. Russell observed that there was another important circumstance to which he had not alluded, and in which great advantage might be derived from the application of a high power: thus the owner of a vessel which usually accomplishes her voyage in fifteen days, but, owing to storms or adverse winds, occasionally takes twenty, must so regulate her stated periods of departure as to allow for these adverse circumstances; and four or five such vessels may be required to keep up a regular communication between places for which three or four would be sufficient, if, by increased power, the average voyage were reduced to ten, and the adverse to fourteen days; and thus a large capital would be saved, as well as more voyages accomplished. The principles which he had developed might also, he thought, be applied advantageously under many other circumstances,—such as in mines subject to uncertain in-rushings of water, &c. In reply to a question, Mr. Russell stated that his principle was only true in reference to vessels making long voyages, for, where not exposed to adverse contingencies of wind and weather, a greater additional power would be merely an additional expense.

On Waves.—Mr. Scott Russell brought up the Report of the Committee (Sir John Robinson and Mr. Russell) on Waves.—Since the last meeting (see *Mech. Mag.* vol. xxix., pp. 410, and 426), the Committee had continued their researches, and had, in each department, confirmed or corrected the results formerly obtained by them, and also extended their acquaintance with several interesting phenomena. The first object of their attention, was the determination of the nature and laws of certain kinds of waves. Of these, the most important species was that called by Mr. Russell the Great Solitary Wave, or the Primary Wave of Translation; the second was the Oscillatory Wave, or secondary species. The recent researches, while they had confirmed and extended to a larger scale the observations of preceding years, have in no respect altered the views formerly stated by this Committee. The form of the wave is that to which the name Hemicycloid has been given; its velocity is that due to half the depth of the fluid, reckoned from the top of the wave to the centre of gravity of the section, where the depth of the channel is not uniform. The motion of the particles, is a motion of permanent translation in the direction of the motion of the wave, through a space equal to double the wave's height; the particles of the water perfectly at rest before the approach of the wave were lifted up, translated forwards, and were deposited perfectly at rest in their new locations—the translation taking place equally throughout the whole depth of the fluid. It had been stated by Mr. Russell, in a previous Report, that all the data requisite to derive the phenomena of the great wave of translation had been now obtained, and that he himself had found no difficulty in obtaining the laws of this wave from the equations of M. Laplace, on the hypothesis, that the motion of the water particles was not infinitely small, and the oscillations infinitely small, as had been hitherto supposed, but that they had the magnitude and nature actually found in these experiments. During the past year, considerable progress has been made in this examination, and highly satisfactory confirmations of the truth of these views had been obtained, by the labours of Professor Kelland, had also adopted the method of introducing the hypothesis of the particles of the water having the motions observed in the experiments—viz. a motion of permanent translation in a given course; and although his results did not perfectly accord with the experiments, they had presented a much closer approximation to them than previous investigations, and were to be regarded as additions to the theory of the motion of waves. The second subject of inquiry by this Committee regarded the connection which existed between the motion of waves, and the resistance of fluids to the motion of floating bodies—a subject closely connected with practical navigation. In the continuation of this inquiry, the Committee had received many confirmations of their former views, while they had been extended beyond their former means of observation. The phenomenon of vessels at high velocities riding the wave, had been exhibited to an extent never before witnessed. It had been formerly observed, that when a vessel was, by any means, drawn along the surface of water with a high velocity, it produced a wave, which was a wave of translation, moving with the velocity due to the depth; and that whenever the velocity of the vessel becomes greater than the velocity of the wave, the vessel is carried along on the top of the wave with diminished resistance. This phenomenon had been last year exhibited on a scale much more striking than formerly. The wave, divided in two by the prow of the vessel, had risen on each side to a height far greater than that even of the vessel itself; it expanded on each side of the vessel, from stem to stern, in a broad unbroken sheet of water, bearing along the vessel between what seemed to be a pair of extended gossamer wings, giving, at ex-

tremely high velocities, a resistance very much less than had hitherto been observed. The third point of inquiry concerns both the theory of hydrodynamics, and the art of practical navigation. What is the form of a solid of least resistance, is a question which has been much discussed since the days of Sir Isaac Newton. What is the shape to be given to a vessel or ship, so that it may be driven by sails, or propelled by oars or steam, with the greatest velocity, or at the least expenditure of power? Is the same question asked by the practical ship-builder, in relation to his art. It had been inferred by Mr. Russell, from certain theoretical considerations, that a certain form, which he called the Wave Form of vessel, would be the form of least resistance, and the form of greatest velocity. This form was, that the lines of anterior displacement should correspond to the outline of the great wave of translation anteriorly, and to the outline of the posterior wave of replacement, towards the stern. This form had been the subject of experiment from 1834 to the present time; and the experiments of last year confirmed the truth of the original supposition, that this form was that of least resistance. A very curious and gratifying confirmation of the truth of the hypothesis had been received during the course of last year. A clergyman in the north of Scotland —the Rev. Mr. Brodie—had seen an account of these experiments in the Reports of the Association, and had deduced from theory, without a knowledge of Mr. Russell's process, results almost precisely the same, so as to give them the most gratifying confirmation, although derived from grounds somewhat different. The views formerly submitted to the Association, on the form of vessel best suited to the practical purposes of navigation, had, during the past year, received very remarkable practical confirmation. A large steam-vessel had been built on the wave principle—a vessel of 660 tons, with an engine of 220 horse power—and it had turned out that this was the fastest vessel now in Great Britain. This vessel, built as a pleasure-yacht, combined the qualities of sailing fast, and carrying a large cargo: she was named the *Fire King*, and belonged to Mr. Ashton Smith, of Wales. The last point of inquiry in which this Committee had been engaged during the past year, was the question of the nature and laws of the tidal wave, as propagated along our shores, and up the estuaries of our great rivers. But the nature of its propagation along our shores, after it ceased to be affected by the celestial influence, formed a terrestrial mechanism, with which we were still very imperfectly acquainted. To this subject, the Committee had devoted their attention, and they had made simultaneous observations for this purpose, at thirteen different stations along the Frith of Forth. The Board of Northern Lights, and Mr. Stevenson, their engineer, had afforded every facility for the observations, and results of a very remarkable nature were obtained. It was found that there were four tides a day in the Forth instead of two—four high waters and four low waters. Mr. Russell exhibited drawings of these tidal waves, and gave, what he conceived the explanation of a phenomenon, which is, he thinks, much more common than hitherto supposed. It is well known, that the tidal wave which brings high water from the Atlantic to the south-western shores of Great Britain, becomes divided into two parts, one of which passes upwards through the English Channel, and the other passing round the west and north of Ireland and Great Britains, bring high water to the east coast of Scotland and to the Frith of Forth. Now, it appears not to have been recollected, that the other wave, after coming up through the English Channel, and bringing along with the former, high water to London, must pass on northwards, and in doing so, will enter the Frith of Forth considerably earlier than the northern wave passings outwards. Now, this southern wave, smaller, but earlier than the other, appears to enter the Frith, and may be traced at every station. It is followed up, however, very rapidly, by the great northern wave, and the former moving more slowly than the other, according to the law of the great wave of translation, is overtaken by it at the higher parts of the Frith, and being both greatly exaggerated by the form of that channel, produces the two tides of the Frith of Forth. Mr. Russell expressed his opinion, that the tides in the upper part of the Frith of Forth would be found to rise as high above the mean level of the sea, as the tides of the Bristol Channel. The observations on this subject were not, however, completed, but would be finished in the course of next year.

Mr. Fox's Electrical Experiments.—Mr. Spencer detailed the following experiment. He took a piece of sulphuret of copper, and placed it in a narrow glass vessel half filled with sulphate of copper in solution, and immersed the sulphuret about half its length in this solution. He then added common salt, taking care that it should not intermingle with the cupreous solution underneath. He then placed in the dark, and left it for a week. At the end of that time he examined it, and had the satisfaction of observing that several portions of it had become covered with very minute crystals of the pure metal.

At the end of a fortnight still more beautiful crystals had been deposited. This experiment, Mr. Spencer stated, was made for the purpose of corroborating the experiment of Mr. Fox, in which that gentleman took a small portion of sulphuret of copper, to which he attached a piece of copper-wire, and at the other end a portion of zinc; the arrangement was separated by a wall of clay, with sulphate of copper in solution in one cell, and a saline solution in the other. Mr. Spencer conceived, that by his arrangement the objection to Mr. Fox's experiment was overcome, viz. that it was always necessary to suppose the presence of two metals.

New Voltaic Battery.—A small voltaic battery of extraordinary energy, was described by W. R. Grove, Esq.:—In a letter published in the *Phil. Mag.* for February, I stated (said the author) some reasons for hoping that by changes in the constituents of voltaic combinations of four elements, we might greatly increase their energy. At that period I sought in vain for improvements, which a fair induction convinced me were attainable, but, being in the country, all my experiments were with copper, as a negative metal. I was constantly unable to use concentrated nitric acid as an electrolyte, and its importance never occurred to me until forced upon my notice by an experiment, which I made at Paris for a different object. This was an endeavour to prove the dissolution of gold in nitro-muriatic acid to be an eletrical phenomenon, or rather that this (as I believe, with Sir Humphry Davy, every other chemical phenomenon,) could be resolved into an electrical one, by operating on masses instead of molecules. The experiment was the following:—The extremities of two strips of gold leaf were immersed, the one in nitric, the other in muriatic acid, contact between the liquids being permitted, but mixture prevented by an interposed porous diaphragm. In this case the gold remained undissolved for an indefinite period, but the circuit being completed by metallic contact, either mediate or immediate, the strip of gold in the muriatic acid was instantly dissolved. Thus, it seems, that the affinity of gold for chlorine is not able alone to decompose muriatic acid; but when it is aided by that of oxygen for hydrogen, the decomposition is effected. The phenomenon bears much analogy to ordinary cases of double decomposition. The two gold strips in the experiment being connected with a galvanometer, occasioned a considerable deflexion; and it now occurred to me, coupling this experiment with my previous observations, that these same liquids, with the substitution of zinc and platinum for the gold leaf, would produce a combination of surpassing energy. My expectations were fully realized; and, on the 15th of April, M. Becquerel presented to the Institute a small battery of my construction, consisting of seven liqueur glasses, containing the bowls of common tobacco-pipes, the metals zinc and platinum, and the electrolytes concentrated nitric and dilute muriatic acids. This little apparatus produced effects of decomposition equal to the most powerful batteries of the old construction. I have since this tried various combinations upon the same principle, and though some of the rarer substances—such, for instance, as chloric acid—have produced powerful effects, I have found none superior, and few equal to the preceding. I have, therefore, directed my attention to using these materials, and rendering the apparatus more economical, although I soon found that it was not so expensive as it at first appeared—the platinum remaining unaltered. Dilute nitric acid dimishes the energy; nitro-sulphuric acid acted as an electrolyte much as nitric acid; it is an excellent conductor, yielding oxygen at the anode, and hydrogen at the cathode. Applying this to my battery, I found it to succeed admirably, and hence a considerable diminution of expense on the side of the zinc, and found salt and water nearly equal to dilute muriatic acid. It also removes the necessity of amalgamating the zinc; but it sometimes, though rarely, disaggregates the porous ware, from the crystallization of nitrate of soda; and, therefore, in large batteries, I should prefer muriatic acid diluted with five times its volume of water. By using flattened parallelopiped shaped vessels, the concentrated acid is much economized and the metals approximated. Now, according to Prof. Ritchie, the power is inversely as the square root of the distance between the metals. The hastily constructed battery which I have to present, consists of an outer case of wood, height 7½ inches, breadth 5, width 3, (it should be of glazed earthenware, similar to the Wollaston troughs,) separated into four compartments by glass divisions; in these compartments are placed four flat porous vessels, the interior dimensions of which are 7, 2½, and 3-10ths of an inch, the thickness of the walls ⅛ inch; they contain each three measured ounces; the metals, four pairs, expose each a surface of 16 square inches, and the battery gives, by decomposition of acidulated water, 3 cubic inches of mixed gases per minute; charcoal points burn brilliantly, and it heats 6 inches of platinum-wire of an inch diameter; its effect upon the magnet, when arranged as a single pair, is proportionally energetic; it is constant for about

an hour without any fresh supply of acids. The porous vessels are identical in their constitution with the common tobacco-pipe. As far as my experiments go, its power, with reference to the common *constant* battery, is *cæteris paribus* as 6 to 1, but the relative proportions vary somewhat with the series. The cost of the apparatus is 2*l.* 2*s.* During the operation of this battery, the nitric acid, by losing successive portions of oxygen, assumes first a yellow, then a green, then a blue colour, and lastly becomes perfectly aqueous; hydrogen is now evolved from the platina, the energy lowers, and the action becomes inconstant. It is worthy of remark, as an argument for the secondary nature of metallic precipitation by voltaic electricity, that the oxidated or dissolved zinc remains entirely (or at least by far the greater portion) on the zinc side of the diaphragm; the hydrogen alone appears to be transferred; and yet the reversal of affinities which the theory of reduction by nascent hydrogen supposes, is an enigma difficult of solution. I have invariably observed in this battery a current of endosmose from the zinc to the platinum, or with the current of positive electricity.

The rationale of the action of this combination, according to the chemical theory of galvanism, appears to be as follows:—In the common zinc and copper combination, the resulting power is as the affinity of the anion of the electrolyte for zinc, minus its affinity for copper; in the common constant battery it is as the affinity of the anion for zinc, plus that of oxygen for hydrogen, minus that of hydrogen for copper. In the combination in question, the resulting power is as the affinity of the anion for zinc, plus that of oxygen for hydrogen, minus that of oxygen for azote. Nitric acid being much more readily decomposed than sulphate of copper, resistance is lessened and the power increased; and no hydrogen being evolved from the negative metal, there is no precipitation upon it, and consequently no counteraction. I need scarcely add a word as to the importance of improvements of this description in the voltaic battery. This valuable instrument of chemical research is thus made portable, and by increased power in diminished space, its adaptation to mechanical, especially to locomotive purposes becomes more feasible.

(To be continued.)

NOTES AND NOTICES.

Submarine Galvanic Telegraphs.—We have received another communication from our friend Mr. Steele on this subject, in which, alluding to what he calls "*the mooring power*" of the steam engine, described in our last number, he observes, that "his flexible tube, containing the galvanised wire, and his steamers, however powerful, are not an electric eel, which can live as comfortably in the storm as in the calm, he only proposes his," he says, "as a moderate-weather theory." He also observes in this letter that, "supposing the tube to be graduated, between the knowledge of position to be obtained by the graduation and the compass in communication together, the steamers could under ordinary circumstances keep their relative places with considerable precision." Mr. Steele anticipates that some highly interesting experiments may be made in electro-magnetism and magneto-electricity, (particularly since the introduction of iron-steamers) by the application of the theory which he has proposed for the consideration of our readers.

Electro-Magnetic Navigation.—Mr. Faraday recently received a letter from M. H. Jacobi, dated St. Peterburgh, on the application of electro-magnetism to navigation, and Mr. Faraday has caused it to be inserted in the *London and Edinburgh Philosophical Magazine* for the current month. The following is a short extract from this very curious paper:—"In the application of electro-magnetism to the movement of machines, the most important obstacle always has been the embarrassment and difficult manipulation of the battery. This obstacle exist no longer. During the autumn of 1838, and at a season (in 1839) already too advanced, I made, as you will have learned by the *Gazette*, the first experiments in navigation on the Neva, with a ten-oared shallop, furnished with paddle-wheels, which were put in motion by an electro-magnetic machine. Although we voyaged during entire days, and usually with ten or twelve persons on board, I was not well satisfied with this first trial, for there were so many faults of construction and want of insulations in the machines and battery which could not be repaired on the spot, that I was terribly annoyed. All these repairs and important changes being accomplished, the experiments will shortly be recommenced. The experience of the past year, combined with the recent improvements of the battery, give as the result, that to produce the force of one horse, (steam-engine estimation,) it will require a battery of twenty square feet of platina, distributed in a convenient manner, but I hope that eight to ten square feet will produce the effect. If Heaven preserve my health, which is a little affected by continual labour, I hope by next Midsummer I shall have equipped an electro-magnetic vessel of from forty to fifty horse-power."

Card-making Machine.—At the model exhibition of the British Association, one of the inventions which attracted most attention was a machine for the fabrication of carding web. This delicate and ingenious instrument unwinds the wire from the reel, bends it, cuts it, pierces the holes, inserts the tooth, drives it home, and lastly, gives it, when inserted, the requisite angle, with the same, or rather with greater precision and accuracy, than the most skilled and readiest set of human fingers could; and with so great expedition that one machine performs a task which would require the labour of at least ten men. An engine of five-horse power, would drive, it is calculated, one hundred such machines.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 841.] SATURDAY, SEPTEMBER 21, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

LORD WILLOUGHBY D'ERESBY'S PATENT PEAT-PRESSING MACHINERY.

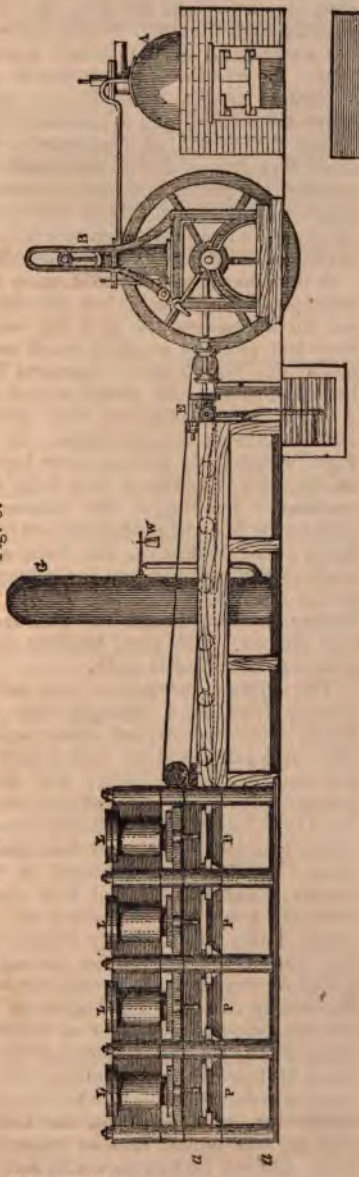


Fig. 6.

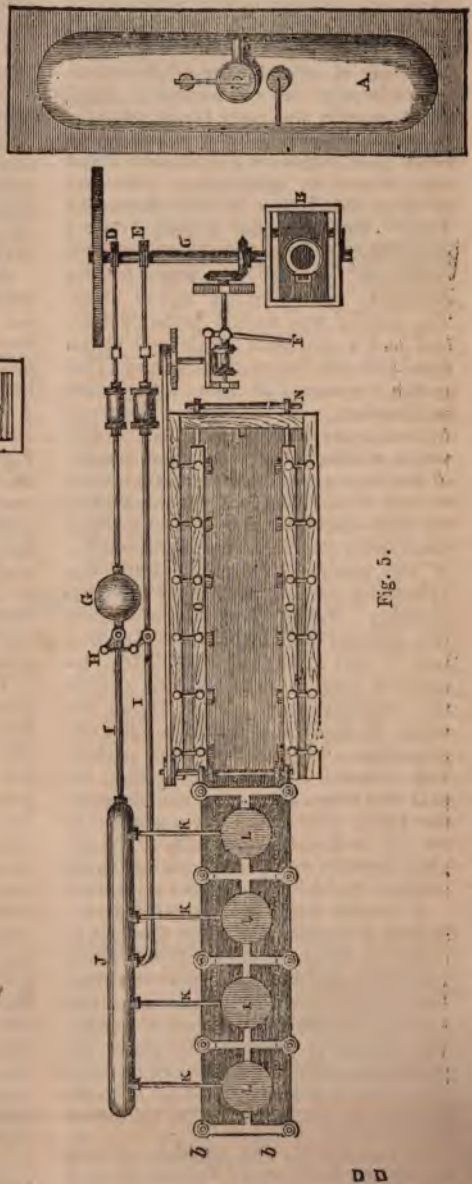


Fig. 5.

LORD WILLOUGHBY D'ERESBY'S PATENT MACHINERY FOR THE COMPRESSION OF PEAT.

During a constant residence in the mountainous districts of Scotland and Wales, where the inhabitants depend chiefly upon peat for their fuel, Lord Willoughby had given much attention to the manner of preparing it for use. From observing the impossibility of rendering it available in a wet season (together with its comparatively small value, even in the most favourable,) for domestic purposes, he was induced to enter upon a series of experiments for its compression by machinery. The first of these took place in the summer of 1834. The machine consisted of a powerful screw-press. The chamber which contained the peat was three feet in diameter, and fourteen inches deep. The interior was turned perfectly true, and had a moveable bottle and piston fitted to it with the greatest accuracy. This piston was moved by a screw 4.5 inches in diameter; and the screw was turned by two levers of 10 feet radius. When put in motion by four men, it was capable of producing an effective pressure equal to 100 tons. The water contained in the peat was allowed to escape through small holes closely drilled in the bottom of the machine, and also round the cylindrical part of it forming the peat-chamber. When finished, the machine was charged with about seven cubical feet of wet peat, and the piston descended upon it by turning the lever in the ordinary way. This forced the water through the apertures in great abundance; but long before the machine had attained its greatest power, the peat also began to exude; and although the holes were only three-sixteenths of an inch in diameter, but little of the original quantity would have remained in the machine, had the pressure been continued.

A second machine was constructed; and on a smaller scale than the first, in order to avoid expence. It was calculated to press but a single peat at a time. Fig. 1, is a front view of this machine,* and Fig. 2, a side view, (see opposite page). The power is produced by racks and pinions in combination with two levers, as shown in the drawing. Instead of round *holes in* the peat-chamber, for the escape of the water, it was formed of vertical bars of iron about half an inch wide, and fixed to strong cast-iron plates, one on each side of the machine, and so close together, that a piece of thin paper could scarcely be inserted between them. The peat, however, when under high pressure, issued through the bars, as it had done through the small circular holes of the screw-press in the former experiment. It was therefore obviously necessary to employ some filtering substance to retain it, and at the same time permit the escape of the water. To effect this it was folded in linen cloth, before being placed in the peat-chamber. In this manner its escape was completely prevented; but the process of compression became both expensive and slow.

A third machine was made upon the principle of the second; but the chamber for containing the peat was somewhat less, and the machine much more powerful. Figs. 3 and 4, represent this machine; it has the piston moved by a crank, in combination with levers, marked A A in the drawings. B, in Figs. 2 and 3, is a short lever for removing the compressed peat from the machines. In Fig. 2, the bottom is withdrawn, and the peat taken out from below; and in Fig. 4, the bottom is made to rise, and the peat is discharged at the top. This machine worked infinitely better than the one with racks and pinions. The peat, however, continued to be folded in cloth.

The original screw-press was subsequently tried on a principle very different from its original construction. The perforated bottom was raised to the top of the cylinder, and there secured with a strong cast-iron frame fixed to it, to support a sliding drawer about two feet square and four inches deep. The peat was placed in this drawer, which was made of iron planed perfectly true; and the piston of the press, which was formerly round, was cut into a square, and by the aid of a leather washer made accurately to fit the sliding drawer. The bottom of the drawer consisted of a layer of ordinary linen cloth, beneath which was a second of hair-cloth; it contained fifteen peats of ordinary size. The machine being ready for an experiment, the sliding drawer, was moved into its place, and there secured by two moveable bolts in front; this being done, four men turned

*This machine was more particularly described and figured in the *Mechanic's Magazine*, vol. xxvii, p. 193, No. 725.

Fig. 6 *a*.

Fig. 5 *a*.

the levers of the screw. No portion of the peat escaped; and the water it contained passed freely away through the filtering bottom. The success of this experiment left little to be desired, except some ready mode of getting clear of the water at the top, and preventing its return upon the compressed peat, or into the machine when the pressure was removed. To effect this, large conical holes in the piston were filled with pieces of beechwood, through the pores of which the water was expelled in an upward direction, and conveyed beyond the edges of the drawer, through channels contrived for that purpose in the piston. The lower surface of the piston was covered with cloth in the same manner as the bottom of the sliding

Fig. 1.

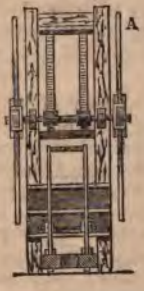


Fig. 2.

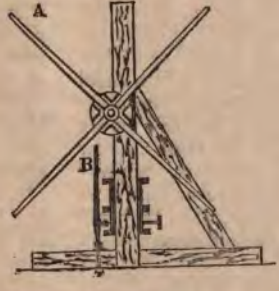


Fig. 3.

Fig. 4.

drawer. The result was that not a drop of water returned upon the compressed peat, or re-entered the machine upon the pressure being removed. It was still evident that greater rapidity in compression was wanted than could be effected by sliding drawers, which required to be removed and replaced each time they were filled and *emptied*.

For this purpose Lord Willoughby *proposed that his next* machine should have two drawers, so connected, that when the one was removed the other would replace it, and the operation of the machine be uninterrupted. In order that they might be emptied with the utmost facility, after the peat had been compressed, they were hinged together, so as to admit of being readily reversed. For the machine, thus improved, a patent has been obtained by Lord Willoughby, extending to England only

but he wishes it to be understood that any individual is at liberty, upon a proper application, to avail himself of the invention gratuitously.

It may be useful to add a few general remarks to the foregoing description. In the selection of peat for compression, care must be taken to obtain a black peat, free from fibre. Peat of the proper description has very much the appearance of blackened butter, and is the only sort which will repay the expense of preparation. The peat should be dug of the usual size, namely, eight inches by three, and three deep, and of a uniform shape, which is easily effected by a spade of a peculiar construction. All attempts which have been made to compress peat in large masses of various dimensions have invariably failed. In every instance the water has been retained in the centre of the mass, and expelled only from its surfaces. Even had the result of these trials been different, the peat so prepared would be useless for general purposes until cut into small pieces. Before compression, the peats must be placed to dry for five or six days under sheds, in the same manner as bricks and tiles, and after compression must remain under cover until perfectly free from moisture, when they will be fit for use. At the recommendation of several friends, Lord Willoughby has attempted to dry them in various ways by artificial heat, but without any satisfactory result. The peat, when properly compressed, is reduced about one-third in size, hard and compact, and nearly black in colour; it varies slightly in density, sometimes floating, at others sinking in water. As to its uses, it will be found an excellent substitute for coal. It may be used in grates for domestic purposes, and has been tried successfully in calcining lime. In an experiment with the steam-engine at St. John's foundry, Perth, where one of the machines already described was made, the peat was found to outlast an equal weight of coal, in the proportion of 16 per cent., the engine being worked at its ordinary rate. There is every reason to believe that it might be employed in the manufacture of gas, which it gives off in abundance, burning with a clear white light. It may also be prepared by charring, in the same manner as ordinary charcoal, by which its size is *reduced about one half.* When charred in this way, the slowness and difficulty with which it burns renders it an extremely valuable fuel in many processes of the arts: this value is increased by its freedom from sulphur, and the comparatively small quantity of ashes which it leaves after burning. For the working of steel in particular, its freedom from sulphur makes it greatly superior to charcoal. It has been applied to this purpose by Messrs. Philp and Whicker, (late Savigny and Co.) St. James's Street, who have used it with remarkable success in forging razors and surgical instruments. The articles bear the stamp "*forged with peat,*" as well as the names of these gentlemen, by whom they are highly recommended. The charred peat has also been employed in the working of other metals particularly in the soldering of the thin brass, with a most encouraging result. In conclusion, it may be mentioned, that it is as serviceable in the kitchen as common charcoal, and occasions no unpleasant taste or smell.

With the view of carrying Lord Willoughby's principle into operation, on a scale of greater magnitude than could be effected by manual labour, he engaged Mr. James White, of Lambeth, to assist him in adapting steam-engine power to his machine. Mr. White, foreseeing some difficulties in the application of any of the former modes of moving the piston, or the plate which compresses the peat, on a large scale, advised the use of hydrostatic pressure. The following is Mr. White's description of Lord Willoughby's machine, with the proposed adaptation of hydrostatic pressure and steam power.

"Fig. 5, is a general plan of this machine; and fig. 6, an elevation. In fig. 5, A is the steam engine boiler; B, steam engine; C, main shaft of engine; D, compressing pump; E, exhausting pump; F, hand gear for reversing the motion of the sliding frames which contain the peats; G, air vessel; and H, two cocks that open and shut alternately, the use of which will be explained hereafter. I and I, are pipes attaching the pumps, D and E, with the vessel J, from which four branch pipes, K, K, K, K, convey the water to the four cylinders, L, L, L, L, and by the high compressure of the pump D, the pistons will be forced out of them; and the compressing plate, to which they are all secured, lowered upon

the top of the peat with a power equal to 500 tons, or more if necessary.

"The peat is to be placed in a sliding frame M,* of which there are two to the machine; one of them being under compression, while the other is being filled. This frame M contains 90 square pieces of peat, as represented in the engraving. They are shown compressed; for the rollers, upon which the frame M runs, have been withdrawn, and left it supported by centres at the ends only. It is now to be turned over upon these centres, and the compressed peats will be emptied into a railway carriage below, which is there to receive them, as shown in the elevation, fig. 6. The sliding frame is to be re-adjusted, and the handle N to be pushed in, as represented at the other end of the machine; this having been done, the small rollers that are fixed, and centered to the parallel guides O, O, will be below it, and support it. It may then be refilled with as much expedition as possible.

"We shall now proceed to describe the mode of raising the pistons and compressing plate, which have been forced down by the introduction of water into the cylinders L, L, L, L, by the compressing pump D.

"The cocks H, are now to be reversed, and the exhausting pump E, will withdraw the compressed water from the cylinders L, L, L, L, and return it to the supply well, seen on the right of the elevation, fig. 6. This will cause a vacuum above the pistons. Hitherto it has only been pumping air to waste. At the same time the compressing pump D will continue storing up its power into the air vessel G, by pumping back the withdrawn water, and be ready for a second operation. If we suppose the four pistons in the cylinders L, L, L, L, are each 10 inches diameter, and the water thus withdrawn, and the atmosphere at liberty to act upon the under surface of the compressing plate, to which the pistons are attached, there would be sufficient power to raise the whole mass, were it not for the adhesion which takes place between the under side of the compressing plate, and the upper surface of the peat. A power equal to 20 tons is requisite to separate them. To effect this object, the compressing plate has eight regulating screws, which come in contact with eight steel bars when down. There are four on each side of the machine, marked P, P, P, P, in the elevation fig. 6. The elasticity of these bars is calculated to overcome the resistance of the atmospheric pressure, which causes the cohesion between the compressing plate and the peat, and the exhausting pump E, to return the pistons and coming plate to their original position, on the admission of air through a valve in the compressing plate. The handle F, of the hand-gear, is now to be reversed, which will bring out the sliding frame, containing the peats that are under compression, and the other sliding frame M, already described, being refilled, will replace it. This having been done, the cocks H, will be returned, and the highly compressed air, in the air vessel G, will force the water, that has been pumped into it by the compressing pump D, to the cylinders L, L, L, L, as presumed to have been the case in the former instance. The second sliding frame M, being now out, the handle N, is to be withdrawn; the frame will then swing upon its centres, the railway carriage being in the position to receive the compressed peats, and the sliding frame will be emptied as before.

"The quantity of peats which may be thus compressed in one day, may be estimated at 27,000, or 45 per minute, under a pressure of 400 pounds on the square inch, with a high pressure steam engine of six horse power. When a greater or less degree of compression is wanted, it can easily be effected by the weight W, on the lever of the safety valve of the air vessel G; but it ought to be mentioned, that loading the valve beyond what the machine is calculated to bear, may cause a fracture in some of its parts, or an explosion of the air vessel."

* The length of our page not being sufficient to take in the whole of the plans of the machinery, we have been compelled to separate the two views of the sliding frame M, from the other parts. They will be found at p. 451, fig. 5 *a* and 6 *a* and their connection with the figures on the front page is marked by the letters *a a*, *b b*.—Ed. M. M.

HARDENING IRON—PULSE INDICATOR—HUMAN RESPIRATION—CARBONIC ACID GAS.

Sir,—Having but just now perused your last month's part of the *Mechanics' Magazine*, which contains five weekly numbers, I found at page 372, a communication from your excellent correspondent, Mr. W. Baddeley, on the sub-

ject of "case hardening" iron. The method to which he has alluded, has been long known and practised by me, and is extremely valuable for its purpose by reason of its leaving the iron perfectly clean, and free from oxidation, or scale. But if it should be desirable to case-harden one surface only of a plate of iron, it would be better to use another material much less known for the present object, and whose *modus operandi* is much more difficult of explanation. I allude to the hydrochlorate of ammonia, a substance well known to coppersmiths, and others, by the name "sal ammoniac." The ferrocyanide of potassium (prussiate of potass,) flows like sealing wax over the heated surface of the iron to be hardened, and is liable to run over and under parts which may not be intended to be hardened. The sal ammoniac has not this propensity.

To use sal ammoniac for case hardening; a piece of this salt of bulk relative to that of the article to be hardened, is to be fixed to a small rod of nail iron by simply pointing the end of the rod, turning it down at right angles, and thrusting it into the tough crystalline mass. The iron to be case-hardened is to be heated to redness, and while it is in this state, it must be rubbed on that side only which is intended to be hardened, for about one or two minutes, with the sal ammoniac (keeping the iron at a good red heat all the time,) and then suddenly immersed in cold water.

At page 389, I observed a description and drawing of a "Pulse Indicator," by "Clio." The design is ingenious, although not applicable to the purpose; for, as the arteries of a human being are not all of the same calibre, and as similarly situated arteries of different human beings are of dissimilar diameters, and as their extreme capability of expansion must depend upon the elasticity of the tube, and as the elasticity of the tube, *cæteris paribus*, must vary with the extent of its circumference, so the indications of Clio's instrument will vary when it is applied to similar arteries of different individuals, or to the large and small arteries of the same individual, although the heart's action may be precisely similar in the one case, and constant in the other.

At page 413, you have inserted the "Experimental researches of Dr. Ure upon the cost of the light afforded by different lamps and candles," from the Transactions of the Institution of Civil Engineers. The comparisons of the relative light afforded by the lamps, and materials which Dr. Ure has examined, may be, and doubtless are, sufficiently correct for every useful purpose; but at the close of the communication the Doctor has asserted that the deterioration of the atmosphere during the combustion of *two* wax candles, is equivalent to that effected by the respiration of an average sized man.

I have been for many months devotedly investigating the subject of human respiration as connected with its effects upon given volumes of atmospheric air, and also the changes that are effected in given volumes of atmospheric air by the combustion of candles, charcoal, &c. In the *London and Edinburgh Philosophical Magazine* for the month of June of the present year, are stated some of the results of my very numerous experiments upon the air respired at almost every hour of the day and night, during eight consecutive days, and it will be seen, from the average of 130 examinations, that the total daily average of the deterioration of the air respired, so far as regards the carbonic acid gas which is eliminated by the lungs of a healthy adult, barely exceeds 4 per cent. It will there be found that the total average quantity of atmospheric air that passes through the lungs of an average healthy adult in 24 hours, does not exceed 266.66 cubic feet, of which 10.66 cubic feet will be converted into carbonic acid gas, which are equivalent to 5.45 ounces avoirdupois of pure carbon. If this be reduced to the hourly product, we have about 768 cubic inches of carbonic acid gas produced by an adult individual, which are equivalent, to 99.6 grains of carbon.

Now, as 100 grains of wax contains 81.75 grains of carbon, (Thenard,) and as 12.94 grains of carbon are equivalent to 100 cubic inches of carbonic acid gas, (Thomson,) the consumption of from 125 to 126 grains of wax candle per hour, will produce 102.3 grains of carbon, which are equivalent to 790.5 cubic inches of carbonic acid gas per hour. Consequently, *one* wax candle of the kind described by Dr. Ure, does actually deteriorate the air of an apartment during its combustion, *to a greater degree* than the respiration of *one* human adult.

From the experiments to which I have alluded, if the population of the United Kingdoms of GreatBritain, Ireland, Scotland and Wales, be for the present year 26½ millions (excluding the army and navy,) as quoted in Dr. R. D. Thomson's *British Annual*, we have no less than ten billions, three hundred and forty-two millions, nine hundred and fifty-seven thousand, two hundred and thirty-four cubic feet of carbonic acid gas, or one hundred and forty-seven thousand and seventy-two tons of carbon, as the present year's residuum from the respiration of the human beings now existing within the circumscribed boundaries of Great Britain and Ireland.

As the subject of carbonic acid gas, and its effects upon human beings, is one of very great interest to me at present, I should feel extremely obliged to any of your readers for their experience, or practical knowledge connected with it; such as the per centage of carbonic acid gas in the atmosphere of those parts of breweries, or distilleries in which fermentation is proceeding, and in which human beings are daily working for a considerable period.

Believe me very faithfully yours,

CHAS. THORTON COATHUPE.

Tower House, Wraxall, near Bristol, Sept. 13, 1839.

ON THE ACTION OF THE CRANK IN STEAM ENGINES.

Sir,—Your valuable magazine contains every year, from different persons, some very clever articles to prove, at one time, that the use of the crank is followed by a loss of 50 per cent. of power; and at other times, to prove that it does not lose any power at all.

Mathematics demonstrate, since some thousand years, in the problem called *the decomposition of forces*, that the crank can only bring upon the axles of a steam-ship, or of a carriage, 50 per cent. of the greatest power of which the steam working in the cylinder is capable; taking for that greatest power, that which it displays in the moment when the piston is in the middle of the cylinder.

Some of the practical men deny this sternly; and for this reason put the question, "Where remains the 50 per cent. power lost?"

Good answers have already been given in your columns; will you allow me to furnish one which I submit to the test of your readers.

All practical men allow that one of the greatest advantages of the crank is to bring the piston in the cylinder gradually to a state of rest, when coming near to one of the bottoms of the cylinder; which bottom would be crushed in pieces at every stroke, without this property of the crank; the piston having its greatest velocity when at the middle part of the cylinder.

Now when the piston is in the middle of the cylinder (that is, when the crank does nothing to prevent the whole and greatest power of the steam to work the piston up or down, as quick as thought), the effect of steam power transmitted upon the axle must be equal to the whole and greatest power of the steam, expressed here by 100.

But in its progress the piston is obliged, by the crank, to go slower and slower; the quickness of its motion diminishes sensibly indeed, till it comes to a state of perfect rest, or at 0 motion. What practical man cares about the power only standing upon the piston without any motion, at the moment just before the valves reverse the steam? Indeed it produces no good effect whatever in favour of the act for which the engine is performing, and will produce no good effect *as just in proportion of the quickness* by which the piston is progressing in the cylinder; which quickness goes gradually from nothing to 100, and from 100 to nothing, all the time the engine is at work.

Now every one has read in elementary books about machinery and calculations, that to obtain *the effect or the power produced* by any working power, you must multiply that working power with its quickness: also, suppose—

6 lb. working power, with 6 feet quickness, gives	6 lb. working power, with 3 feet quickness, gives	6 lb working power, with 0 feet quickness, gives
36 lb. power produced.	18 lb. power produced.	0 lb. power produced.

This diagram shows that the word *power* in the above question of the doubtful practical man is used in a state of confusion. Indeed, the topmost stand-

ing 6 lb. of up and down *steam power*, remain in those three multiplications without alteration; but the *power produced* in every multiplication, in our case *the rotatory power* transmitted to the axles, changes totally. To inquire what becomes of the power lost by the crank is only to make use of improper words. The proper expression will be, what becomes of the time, or of the quickness lost by its use, during the period the piston performs one stroke.

The plain answer will be, *just half that quickness* which the piston has, when arrived on the middle of the cylinder out of the action of the crank, which is lost or is not produced, and cannot communicate any effect of rotatory motion on the axle.

That time is power is also true in a philosophical and mechanical point of view, and is known since mathematics were cultivated by men.

I dare say that every practical man who was so anxious about the 50 per cent. power lost by the crank, will find in the consideration of time room enough to ease his mind, and believe with the dynamique, that every working power is decomposed, or loses *its effect*, by the more or less obliquity of its working.

Mathematics may be dry as dust, but never will it be a liar.

The argument founded upon some pumping engine, with or without crank, will I trust be solved by the same consideration, or in examining what is the means used to hinder the piston to strike at the bottoms of the cylinder; this cannot be obtained without loss of quickness or loss of the power employed, and we have seen that those two words turn out to express the same thing in the case we examine.

In the actual advanced state of steam navigation and steam locomotion, a clear idea of *what the crank produces upon the rotatory power communicated to the axles* is of the greatest moment, even in the supposition that never any rotatory engine will prove to be a practical thing.

Upon this basis I hope, Sir, that you will allow room in your valuable columns to my humble explanation, in a controversy already in the way to be solved in your Magazine.

I am, with all consideration, Sir, your devoted servant,

A. GORDON.

18, Finsbury-street, London, Sept. 14, 1839.

SELECTIONS FROM THE PROCEEDINGS OF THE BRITISH ASSOCIATION—NINTH MEETING—AT BIRMINGHAM.

[*Abridgement of Athenæum Report.—Continued from page* 448.]

Pneumatic Speculum. — Mr. Nasmyth exhibited this instrument of his invention. The glass was 3 ft. 3 in. in diameter, and three-sixteenths of an inch thick. It was placed on a concave cast-iron bed, and fastened in with bees' wax which rendered the apparatus air-tight. By drawing out the air from behind the mirror, which Mr. Nasmyth did with his mouth by means of a stop-cock, the surface of the glass became instantly concave, and by withdrawing a little more or little less air, the focus could be varied at pleasure: indeed, Mr. Nasmyth had no doubt that he could in this way bend the glass till it broke.—Prof. Forbes said, he should very much regret, on the score of disappointment and expense, if, by any accident, Mr. Nasmyth should chance to break the mirror; but, he must own, that if such an accident did happen, he should like to examine the fracture, as he thought a fracturing force laid on with the regularity of *atmospheric pressure*, was not to be obtained by almost any other contrivance, and an examination of the fracture would probably throw some light on the molecular forces of aggregation and of elasticity. He thought also, that the unfolding of some new views interesting to his geological friends, might be the result.

Measuring Daylight.—Dr. Ure read a paper "On Photometry, or a mode of measuring diffuse day-light comparatively, at any time and place."* When lights of different intensities have the same quality of tint, or tone of colour, they may be measured relatively to each other, by the relative depths of shadow which they project upon a white wall or screen, from an opaque body interposed. The light of oil lamps and of candles, either wax or tallow, has the same yellowish tint, and may be most exactly measured by placing the several luminiferous foci at such distances from the screen, as that the shadows which they let fall from one and the same object, shall be all of equal depth. And since lights diminish in proportion to the squares of their distances, we

* See also an account of Dr. Daubeny's apparatus, described in Mech. Mag., p. 428.

have merely to square the respective distances of these luminiferous foci from the screen, to obtain an exact measure of their relative intensities. For example, when a wax candle of three to the pound, and a good mechanical or Carcel lamp, are placed respectively at distances of three and of ten feet from the screen, their flames will be found to project shadows from a slender cylinder of equal depth. Now, the squares of these numbers being 9 and 100, will denote the relative illuminating powers of the candle and the lamp. When the tint of the light, however, is very different, as with the blueish flame of gas, the vivid white of an argand lamp fed with oxygen (called the *Bude* light), or the gray light of the sky, it becomes very difficult to measure the respective intensities of such lights, by comparing the shadows which they project, with the shadows projected from the flame of a standard or wax candle, or a mechanical lamp. I experienced this difficulty, (Dr. Ure observed,) of late upon two interesting occasions. The first was in trying to measure the relative illuminating powers of the Bude light, in subserviency to my examination before the Select Committee of the House of Commons, on lighting the House. The second was in estimating the degree of obscuration of daylight, produced by a high wooden wall or hoard, recently erected in a garden behind two valuable houses in George-street, Hanover-square, London. The landlords of these houses, justly conceiving that such a wall, if permanently built, (as was intended,) would greatly deteriorate the value of their property, were advised to sue for an injunction against it. As certain surveyors and architects had taken upon them to declare in their affidavits, that the obscuration produced by the said hoard was inconsiderable in itself, and did not materially impair the comfort of the tenants of the houses, I was called upon, by the solicitors for the plaintiffs, to investigate scientifically the darkening effects upon the windows and principal apartments of the said houses produced by the hoard, and to show that they were not matters of vague opinion, but were points susceptible of physical demonstration and accurate measurement. After several trials, I satisfied myself that the method of comparing the shadows projected by the windows opposite the hoard, and those from the windows of an adjoining house, not opposite to it, with the shadow of a standard wax candle, was not capable of affording uniform results, even when the yellow light of the candle was modified by a plate of pale blue glass. I had recourse to another photometric *plan, which appears to be free from all ambiguity or source of error.* The chloride and several other salts of silver are so very sensitive to light, as to take a dark grey tint from exposure to diffuse daylight in a very short time. When the aspect of the sky continues uniform for two or three hours, paper imbued with the nitrate, carbonate, chloride, or phosphate of silver, will assume a depth of grey or brown tint proportional to the time of its free exposure to the day. Availing myself of this principle, I simultaneously placed pieces of paper so prepared, in the apartments subject to the darkening influence of the wall, and in apartments of the adjoining house, not under that influence. The papers which enjoyed the free aspect of the sky, having assumed a decided depth of hue in half an hour, I folded them up from the light, and proceeded to watch the papers placed opposite to the windows less or more obscured, till I observed them to take the same depth of tint. I found that in the dining-room of the house No. 16, in George-street, the paper exposed at the determinate distance from the windows, required three hours to acquire the same dark colour, and in the dining room of the house No. 17, it took an hour and a half. Hence it may be certainly concluded, that the daylight in the said apartment of No. 16 was diminished six-fold, and in that of No. 17, three-fold, by the interposition of the hoard. A piece of the paper laid upon the sideboard of the dining-room in No. 16, continued during the whole of a bright summer's day, without being perceptibly darkened in its hue; proving very manifestly that hardly any sky light at all was allowed to reach the bottom of this fine room, which is thirty-two feet long. The relative degrees of diurnal illumination in different apartments of any house—in different countries—or on different days in the same place or country, may thus be accurately measured and permanently registered by a series of photogenic impressions of any form, which will exhibit the progressive depths of tint, after an exposure during a certain number of minutes to diffuse daylight; care being always had to prevent the direct or reflected impulsion of the sunbeams. The tints thereby produced being fixed by water of ammonia, hyposulphite of soda, or any of the well-known photogenic expedients, will serve as standards of comparison to enable us to estimate the vivacity of daylight in any region of the globe, from the time in which paper similarly prepared with a standard salt of silver, acquires from exposure to daylight the same hue. And since the comparison of tints may be made with considerable precision by an experienced eye, this photometric method may prove a valuable addition to the scientific resources of the meteorologist.

Measuring Fluidity or Viscidity of Oils, &c.—Dr. Ure also detailed a number of "experiments to determine the fluency or viscidity of different liquids at the same temperature, and of the same liquids at different temperatures."* Having been employed professionally, (Dr. Ure observed,) to investigate the operation and merits of a new lamp, recently patented by Mr. Parker, in which the oil is heated by the flame of the lamp to the temperature of from 200° to 250°, before arriving at the wick, it was desirable to determine the degree of fluency imparted to oils by a certain elevation of temperature. The light emitted by this lamp, when supplied with the viscid, and very cheap, but nearly scentless, southern whale oil, surpasses, in purity and whiteness, the light of the best mechanical lamp, though it be fed with the best vegetable or even sperm oil. This superiority is in part due to the form of the chimney, and to the oil being maintained uniformly at the level of the bottom of the flame; but it must also be ascribed, in a certain measure, to the high temperature and fluency of the oil, by which it enters more readily into complete combustion, than cold and viscid oil could possibly do. The preparatory heating seems to act on the same principle here, as it does in the smelting of iron by the hot blast. Having presented a memoir upon the subject of the lamp to the Society of Civil Engineers, which will appear in their Transactions, I shall decline entering at present further into its merits. In that memoir, I stated the results of some experiments which I had then made upon the fluency of liquids, by means of an apparatus, consisting of a small glass syphon, and a platina capsule, containing a measured quantity of the liquid to be run off through the syphon. Having since had reason to imagine that certain numerical errors had been occasioned by variations in the position of the syphon, though the general results are true, I have recently repeated the experiments with another form of apparatus free from that fallacy, and submit the following brief account of them. Upon this occasion I put the liquid, either cold or heated to a certain temperature, into a glass funnel, terminated at its beak with a glass tube of uniform bore, about one-eighth of an inch in diameter, and three inches long. The funnel was supported in a chemical stand, and discharged its contents, on withdrawing a wooden pin from the beak, into a glass goblet placed beneath, alongside of which a chronometer was placed to indicate, in seconds, the time of efflux. The volume of liquid used in each case was the same,—viz., 2,000 grain measures, at 65° Fahr. The times of efflux with liquids of the same specific gravity and bulk, in the same vessel, vary with the viscidity of the liquids, and serve to measure it. A correction ought to be introduced in estimating the times of efflux of hot liquids, on account of the enlargement, by expansion, of the bore of the glass tube; but this, being a point of little consequence in the practical application of this inquiry, has been neglected.

2,000 grain-measures of water, at	60°	Fahr., ran off in	14 seconds.
	68		13
	164		12

When the funnel and glass tube were faintly smeared with oil, though perfectly pervious, and apparently clean, boiling hot water having been run through them :—

2,000 grain-measures of water, at	150°	Fahr., ran off in	24 seconds.
	142		23
	94		24
	56		25

So great is the repulsive influence between oil and water, in retarding the flow of the latter through a small orifice.

2,000 grain-measures of	Fahr.	Spec. grav.	Sec.
Oil of turpentine	65°	0.874	14
Pyroxylic spirit	"	0.830	14½
Alcohol	"	0.830	16
Nitric acid	"	1.340	13½
Sulphuric acid	"	1.840	21
Ditto	262	"	15
Saturated solution of sea salt	65	1.200	13
Sperm oil	"	0.890	45½
Fine rape-seed oil	"	0.920	100
Fine pale seal oil	"	0.925	66

* *In vol. xxix, of the Mech. Mag.*, p. 154, we published a description of a very ingenious instrument for this purpose, invented by Mr. Macnaught, a clever mechanician of Glasgow. Ed. M. M.

2,000 grain-measures of	Fahr.	Spec. grav.	Sec.
Fine South Sea whale oil	"	0.920	66
Sperm oil	254	"	15
Rape-seed oil	254	"	17
South Sea oil	250	"	17

The rape-seed oil is so viscid, as to burn with difficulty in lamps of the ordinary construction, but in the hot oil lamp of Parker it affords a very vivid light. In my former apparatus, the difference of level between the two legs of the syphon, which constituted the effective pressure of efflux, was only half an inch, whereby 2,000 grain-measures of sperm oil, at 64°, took no less than 2,700 seconds to run off, while that volume of oil of turpentine ran off in 95 seconds. It would, therefore, appear that the fluency of a viscid oil diminishes in a very rapid ratio with the diminution of pressure. Hence, an oil will burn well in a mechanical lamp, where it is raised to the level of the bottom of the flame by pump work, which will afford a very indifferent light in one of the French Annular, or Sinumbral lamps, where the supply is given by a very slight pressure.

Prof. Forbes asked what was the diameter of the orifice of the funnel through which the fluids ran, and what was the quantity of each fluid experimented upon.—Dr. Ure said, that the orifice had a diameter of one-eighth of an inch, and the quantity of each fluid used was 2,000 grains.—Prof. Forbes said, that the interest he felt in these experiments arose from the great importance, in some of the researches he was engaged in, of sustaining the action of the lamp in an unchanged state during the progress of an experiment, and sometimes during a series of experiments; but the changes to which even the best ordinary lamp was subject were so anomalous, and the causes so beyond the reach of discovery, as to be quite disheartening. The instrument that he used for measuring minute changes of temperature was so delicate, that the heat given out by even an apparently well-burning lamp, often appeared to be in a constant state of change, the needle indicating it by an almost constant oscillating motion of even several degrees; even lamps, whose wicks were made with the greatest care, were subject to these changes; and the only wicks which he had found to furnish a sufficiently steady temperature for his purposes, were those made by Locatelli, of Paris.

Manufacture of White Lead.—Mr. Benson read a paper on the theory of the formation of white lead. The carbonate of lead formed by the common process is anhydrous, amorphous, and contains one proportional each of carbonic acid, oxygen, and lead. In order to explain my views (said the writer), *I shall have to advert*, for a moment, to the oxide of lead, termed litharge. Litharge is seldom manufactured with a view to its ulterior application, as it is produced as a secondary product in the separation of silver from lead, even under Mr. Pattison's arrangements, in quantities too large for the demands of commerce. A considerable proportion of the litharge made must, therefore, necessarily be reduced again into the metallic state, and, during this reduction, 7 per cent. of the weight of the metallic lead is lost by sublimation, and by combining with the earthy matter of the coal. Now, as litharge is a protoxide of lead, it has been thought that in order to effect its conversion into white lead, nothing more was requisite than to combine it with a due proportion of carbonic acid; and from this mistake, a variety of fallacious processes have been projected. The processes to which I allude, are founded upon bringing the litharge into solution as a basic salt, and then precipitating it as a carbonate by the injection of carbonic acid. Painters maintained that this precipitate was not white lead. Chemists, finding, by analysis, the correct proportions of protoxide of lead and carbonic acid, attributed the opinion of painters to prejudice. Dr. Ure was, I believe, the first to discover in what the difference between the precipitated carbonate and white lead consisted. I have already stated, that white lead produced by the usual mode of manufacture is amorphous, and, in oil, opaque; whilst, by microscopic observations, Dr. Ure has ascertained, that the former is semi-crystalline, and, to a certain degree, transparent. The difference between white lead and precipitated carbonate may be illustrated by comparing them to pulverized chalk and powdered marble; both are carbonates, but the one is crystalline, the other is not, and one is, consequently, less opaque than the other; and this difference is, of course, more appreciable, when the powders are diffused through highly-refracting media, such as oil. There is one mode by which this difficulty may be avoided, and this was arrived at previously to the discovery of Dr. Ure, as a deduction from a different train of reasoning. The rationale of both the processes, of that which produces the crystalline, and of that which produces the amorphous carbonate, is the same. In both, the lead is converted into basic acetate—in both, the salt is decomposed by carbonic acid, but in the former the process is modified by the pressure of water. In the one the carbonate has been

deposited from a solution—in the other, the particles, never having departed from the solid state, have not been at liberty to arlarge themselves symmetrically. In order, therefore, to produce amorphous carbonate, or white lead, from litharge, it became necessary to present the oxide of lead with a quantity of acetic acid so minute, that an insoluble basic salt should be formed, with a quantity of moisture merely sufficient to determine the action of the carbonic acid. The process would then resemble, in all respects, the ordinary one, except that in the one the lead has been previously converted into oxide, in the other, the formation of the oxide goes on simultaneously with that of the carbonate. The process has been carried out on a scale of considerable magnitude at Birmingham Heath. The quantity of acetic acid used is less than 1.300th of the weight of the litharge, and the quantity of moisture found to be most advantageous is such as will just render the litharge sensibly damp to the touch. A purer and more economical source of carbonic acid than bark has been found in the combustion of coke, and powerful machinery has been applied to facilitating the process, by exposing new surfaces to the action of the gas. The result has been, that the process is completed in as many days as the ordinary one requires months, and the product is of a purer white, and in opacity or body, and all other respects, at least equal to the usual white lead of commerce. One or two other facts deserve mention, which are not generally known. It is singular, that if the protoxide of lead known as massicot, and the protoxide known as litharge, be exposed to a high temperature, approaching to a red heat, the massicot will rapidly absorb oxygen, and become the ordinary red lead of commerce; while the same process goes on exceedingly slowly with the litharge, if at all; but, on the other hand, if massicot and litharge be moistened with dilute acetic acid, and exposed to carbonic acid, the litharge will be converted into carbonate before the massicot is much affected. Another fact is, that white lead and oil combine with so much energy, that if linseed oil be poured upon a large quantity of white lead, and the mass be left undisturbed for a few hours, the temperature will become so elevated, as to carbonize the oil, and render the whole perfectly black. It seems also not generally known, that white lead possesses the power of destroying the colouring matter of linseed oil. If sulphate of barytes be mixed with one portion of oil, and white lead with another portion, the latter will appear comparatively white. If the two mixtures be allowed to remain for some days undisturbed, a quantity of oil will gradually rise to the surface of both. In the former, the supernatant oil will have undergone no change—in the latter, the oil will be nearly deprived of colour, and will have acquired the degree of rancidity, termed by painters fat. The colouring matter has not combined, as might have been expected, with the white lead, for if this be dissolved by the agency of a weak acid, the disengaged oil will also be found to have been bleached. A large quantity of white lead is required to produce this effect, and the precipitated carbonate is less efficient than the white lead of commerce.

Resistance of Atmosphere to Railway Trains.—Dr. Lardner communicated at great length, the experiments he performed with Mr. Wood on the Great Western and other railways, on atmospheric resistance, and the particulars of which we published (vol. xxx, pp. 266, 297, 370) at the time of their being made; further details the limits of our publication will not allow, but we shall give a re-statement of his conclusions. He said that he reserved to himself the power, when the experiments should be all reduced, of modifying these conclusions, if it should appear necessary to do so. He stated, that many of the experiments had been only recently made, and had, consequently, not been submitted to mathematical analysis. Meanwhile he had taken care to lay nothing before the section, except what had been fully borne out by the experiments themselves. He regarded the following conclusions as established by his experiments:—

1. That the resistance to a railway train, other things being the same, depends on the speed.

2. That at the same speed the resistance will be in the ratio of the load, if the carriages remain unaltered.

3. That if the number of carriages be increased the resistance is increased, but not in so great a ratio as the load.

4. That, therefore, the resistance does not, as has been hitherto supposed, bear an invariable ratio to the load, and *ought not to be expressed at so much per ton.*

5. That the amount of the resistance of ordinary loads carried on railways at the ordinary speeds, more especially of passenger trains, is very much greater than engineers have hitherto supposed.

6. That a considerable, but not exactly ascertained, proportion of this resistance is due to the air.

7. That the shape of the front or hind part of the train has no observable effect on the resistance.

8. That the spaces between the carriages of the train have no observable effect on the resistance.

9. That the train, with the same width of front, suffers increased resistance with the increased bulk or volume of the coaches.

10. That mathematical formulæ, deduced from the supposition that the resistance of railway trains consists of two parts, one proportional to the load, but independent of the speed, and the other proportional to the square of the speed, have been applied to a limited number of experiments, and have given results in very near accordance, but that the experiment must be further multiplied and varied before safe, exact, and general conclusions can be drawn.

11. That the amount of resistance being so much greater than has been hitherto supposed, and the resistance produced by curves of a mile radius being inappreciable, railways laid down with gradients of from sixteen to twenty feet a mile have practically but little disadvantage compared with a dead level; and that curves may be safely made with radii less than a mile; but that further experiments must be made to determine a safe minor limit for the radii of such curves, this principle being understood to be limited in its application to railways intended chiefly for rapid traffic.

Gravity or Density of Steam.—Dr. Ure read a report on "the Specific Gravity or Density of Steam at successive Temperatures."—This Report was made agreeably to a motion at Newcastle, calling on Dr. Ure, Mr. Faraday, Mr. B. Donkin, and Mr. Cooper, to draw up a view of the present state of our knowledge upon that subject. The other members of the Committee having declined to enter upon the research, Dr. Ure undertook it. He began his Report by stating that M. Gay-Lussac was the first philosopher who devised and executed an exact process for determining the specific gravity of steam and other vapours; his principle being to measure the volume of vapour furnished by a given weight of liquid. Having weighed a glass bulb, like that of a thermometer, he filled it, by heating it, and plunging the point of its capillary tube in the liquid to be converted into vapour; repeating the heating and immersion till it was perfectly full. It was now slightly heated, to expel a drop of the liquid from the point, which was then hermetically sealed by the blowpipe. The bulb was next introduced into a graduated bell-shaped jar, about one foot long, and two inches in diameter, filled with and inverted over mercury, in a cast-iron pan. The jar was surrounded by a glass cylinder, open at each end; and the space between the two vessels was filled with oil, or water, according to the volatility of the liquid. The interstitial column of liquid rested upon the column of mercury in the iron basin or pan. This was placed over a little furnace, whereby the mercury and superjacent oil were heated to any desired pitch. Eventually the bath became hot enough to generate vapour of such tension within the bulb, as to burst the thin glass of which it was blown. In the case of water, M. Gay-Lussac continued to heat the apparatus, till the water contained between the two cylinders had entered into a state of steady ebullition; and he then measured the space occupied by the steam generated from the bulb in the bell jar, taking care to note the height of the quicksilver within the jar above its level in the basin. Deducting this height from that of the barometer in the same apartment, he found the pressure of the internal vapour. He then reduced, by calculation, the length of the mercurial column to what it would have been at the temperature of melting ice; and made a small correction for the height of the liquid column between the two cylinders. In this research we must take care that the whole of the liquid in the bulb is reduced into vapour, otherwise we shall fall into great errors. This circumstance would occur if more liquid were introduced into the bulb than would fill the whole space over the mercury in the bell jar, at the given temperature. M. Gay-Lussac found, in this way, that one cubic inch, or a gramme measure of water, produced 1,694 cubic inches, or gramme measures, of steam, at the temperature of 100 cent., or 212° Fah., under a pressure of 29.912 inches of mercury, or that of the atmosphere in the mean state of the barometer. He reduced that volume to what it would be at 32° Fah., by the rule for estimating the expansion of gaseous matter by heat, and concluded that the specific gravity of the vapour of water was to that of air, both at the said temperature, as 0.625 to 1.000. The following table of densities includes all the vapours which he subjected to experiment upon that occasion:—

Air (at 0° cent.) being called..	1.000
Vapour of water.....	0.625
Alcohol	1.613
Sulphuric ether	2.586
Sulphuret of carbon	2.645
Oil of turpentine	5.013

The density of the vapour is evidently irrelative of the boiling point, or density of the liquid from which it is formed; for ether boils at 98° Fah., and has a specific gravity of 0.700 or somewhat less, while oil of turpentine boils at 316° Fah., and has a specific gravity of 0.870.

The steam which issues from the spout of a tea-kettle is no hotter, as measured by a thermometer, than the boiling liquid within, and yet, when condensed in a body

of cold water or ice, it gives out as much heat as one thousand times its weight of boiling water would do. This heat of steam, which is insensible to the thermometer is called latent heat, and it differs in quantity for different kinds of vapour. One part of water at 212° Fah. requires for its conversion into steam, as much heat as would raise 5½ parts from the freezing to the boiling temperature, as as would heat it up to 1170° Fah., could the water be made to receive that heat without changing its form. The quantity or energy of heat which steam contains or possesses is constant; that is, for equal weights, steam of every temperature and density contains the like quantity of heat;—a proposition which has been proved by accurate researches. Water at all temperatures, even in the state of ice, is convertible into vapour: the density of this vapour depends upon its temperature; so that this density, that is, the weight of the steam under a given volume, is greater the higher the temperature at which the steam is generated over water. When the steam is not in contact with water, it follows the same law of expansion with heat, as gases do. An air-tight boiler having a vacant space over the water of about 1,700 cubic inches, contains at the temperature of 212°, one cubic inch of water in the state of vapour, and has therefore a specific gravity of 0.000589; water being 1.000000; $= \frac{1.000000}{1700}$. If the heat be raised to 234.5°, the incumbent steam will acquire an elastic force equal to 45½ inches of mercury or 22.3lb. upon the square inch, and a density of 0.000867; if to 250.2°, the elastic force will be 59.8 inches of mercury, or 29.26 pounds, and the density will be 0.001114. In the former case, the elasticity has increased about 50 per cent., and the density 34.3; in the latter case the elasticity has increased another 50 per cent., and the density 32.1; thus, while the elastic force is doubted, the density is increased in the proportion of 1114 to 589 or 100 to 53. We see, therefore, that the elasticity of steam increases with the density, but in a greater proportion, or more rapid ratio. Since like weights of steam contain like quantities of heat, and since the elastic force of steam is the moving power in steam engines, it follows, that for like quantities of heat, or fuel well applied, a greater effect will be obtained from steam of high temperature and density than from steam of lower temperature and density. At all temperatures, the sum of the latent and sensible heats of steam is a constant quantity, so that steam of higher density and temperature *contains always the same* quantity of *heat, as steam of lower* density and temperature. *When denser* steam flows into a vacuous space, it will fill it entirely without condensation, provided that no heat is dissipated outwards; and it will possess an elasticity and temperature dependent upon its expansion. Suppose, for example, that a vessel of one cubic foot capacity is filled with steam of 212° Fah., let this vessel be placed in communication with another air-tight vessel, of nine cubic feet capacity, so as to expand into it; in filling the latter, it will become expanded into ten times its bulk, and from the table which accompanies the report, it will be found to assume, when thus expanded, a temperature of 108.5° Fah., while its elasticity falls to 2.4 inches of mercury; though the steam has neither absorbed nor emitted any heat, nor deposited any water by condensation. When dense steam escapes into the air, it assumes the same specific gravity and elasticity as the atmospheric vapour.

The table annexed contained seven columns; the first three were the scales of the three thermometers now in use; and Dr. Ure remarked, that it was to be regretted, that we in Great Britain do not adopt the Centigrade scale, as the Germans are now doing, instead of the arbitrary and inconvenient divisions of Fahrenheit. The fourth and fifth columns exhibited the elastic forces of the steam, the former in inches of mercury, the latter in pounds upon the square inch. The sixth column showed the number of cubic feet of steam resulting from one pound of water, and the seventh the specific gravity of the steam, water being called unity, or 1.000000.

EXPERIMENTS ON THE POROSITY OF A MASS OF COTTON.

[*From the Journal of the Franklin Institute.*]

Sir,—Perhaps you may consider the following pretty experiment on porosity, worthy of a place in your Journal. Fill a common glass tumbler, or other vessel, completely with some spirituous liquor, so that a few drops more would cause it to overflow. This done, you will find no difficulty in introducing into the tumbler, so filled, *a whole handfull of raw cotton.*

This experiment was suggested by the accidental recovery of some wet cotton from a boat which had been sometime sunk in the Tennessee river; it was found by the workmen that after they had squeezed out the water from some cotton, the vessel in which it had been contained, remained nearly as full as before the cotton was removed.

Spirits answer better than water, for trying the experiment, from the rapidity with which they are absorbed by the cotton. Se-

veral theories were started by persons who tried the experiment; such as, that the filaments of cotton occupied the vacancies between the globules of water; or that by its capillary action, the cotton subdivided the globules, and caused them to occupy a less space, &c.; to me, however, it appears to be accounted for more satisfactorily, by supposing the fluid to insinuate itself between the filaments of cotton, and thus permit the latter to occupy no more space than is due to their actual solidity. The experiment is certainly a beautiful one.

Very respectfully yours, &c.,
JOHN C. TRAUTWINE.

Knoxville, Tennessee, June 12, 1839.

NOTES AND NOTICES.

Locomotive Steam-Tugs on Canal Banks.—From an article in the *Liverpool Mercury* of Friday last, it appears that the mode of applying steam to the banks of canals, which has recently been put into operation on the Forth and Clyde canal, was suggested by Mr. Egerton Smith, in that newspaper nine years ago. The merit of the suggestion has also been claimed by a Mr. Graham, and a Mr. Hyde Clark, but it would seem that Mr. Smith was several years in advance of either of those gentlemen.

Mersey Tunnel.—A meeting was lately held at Liverpool, for the purpose of forming a company to undertake to make a tunnel under the Mersey, to connect Liverpool with the Cheshire side of the river. Mr. Stevenson, Mr. Vignoles and other eminent engineers, declared the undertaking practicable.—*Chester Chronicle.*

Improvement of Musical Strings.—It has long been matter of regret that the strings of the harp, guitar and violin, affected by the atmosphere or by the temperature of the apartment or theatre in which they were found, were liable to get out of tune and produce discord, instead of "discoursing eloquent music." Some experiments were made a few evenings ago at the Crown and Anchor Tavern, on strings prepared on a new plan. Their tones were much admired, and some admirable performances on the harp and guitar by a young lady and Don Ciebra, certainly displayed them to the greatest advantage. It was shown that they could resist heat in an extraordinary degree, as plunged in hot water, which instantly destroyed the common strings, they came out wholly uninjured.

British Association Fracas. The Neptunian Philosophers and Tom Thumb.—Mr. John Scott Russell who has received various grants of money from the Association for the purpose of making experiments in the forms and motions of vessels and waves, brought forward the results of his experiments, and exhibited a number of models of boats of various forms and the results of each. He gave a long account of these results, which are uninteresting, except in so far as it gave rise to the following reply on the general principles by which the affairs of the Association are managed, after Mr. Russell had read his paper. Professor Oliver Byrne, college of C. E. London, strongly opposed this theory, and said, he (Mr. R.) had changed his hypothesis three times since he began to investigate this subject under the sanction of the Association, and at its expense. Mr. B. referred to a former discussion in the mathematical section, when he showed that the forms of the vessels did not depend on any particular section of the wave; and pointed out an omission on the part of Mr. Russell of the action of the back-wave occasioned by the motion of the paddles. He also stated that it was impossible to copy a model and multiply it, without a certain rule or form; and, therefore, that any further experiments in the model-system was useless, and wasting the funds of the Association. Mr. Russell (said Mr. B.) wishes some more money from the Association. (*"Order! order! and a great uproar."*) The Chairman interfered, and Mr. B. said, "I withdraw." He did not wish to hurt the feelings of Mr. R., but as a member of that Association, and contributing to its funds, he, and the members of the Association at large, had a right to know how they were appropriated, and if for the "advancement of science." (*Cheers.*) He would relate an anecdote bearing upon the point. (*Cries of "No! no!" "Yes! yes!" and confusion.*)—Mr. Byrne: Mr. Chairman, may I be allowed to relate an anecdote? The Chairman nodded assent, and Mr. B. continued—There was a certain batch of philosophers, who took it into their heads to search for the fossil remains of Tom Thumb,—(*loud laughter*)—and, in order the more effectually to accomplish their object, they made a model of this diminutive specimen of humanity. But, their object being unattainable, their labours were in vain, so, in like manner, these Neptunian philosophers —(*laughter*)—(he alluded to those who had obtained grants to make experiments on waves, tides, and boats,) had made models, and the attainment of their ends was just as possible as the former. He would conclude by observing that, though they (the Neptuniad) *gain* in the close boroughs of science, they could not stand the test of an open country election. (*Loud cheers and laughter.*)—*Birmingham Advertiser.*

Artesian Well at Grenelle.—At the last sitting of the Academy of Sciences, M. Arago stated that he had that morning been making some thermometrical experiments at the Artesian well at Grenelle, in order to ascertain the temperature at the depth which had already been attained, viz., 483 metres or 1584 feet. When the workmen had reached 460 metres the chalk was of a green colour, indicating the proximity of water. Since then the chalk had become mixed with clay, and of a dark colour, a still stronger indication that the sheet of water which it is intended to meet is near. M. Arago used the thermometer of M. Walferdin, and after having taken all the necessary precautions in order that the pressure, which at such a depth is equal to fifty atmospheres, might not injure the bulb, six thermometers of the same kind were successively let down to a depth of 481 metres, care having been taken not to lower them until thirty-six hours had elapsed before the boring, in order that the heat which this work might have communicated should have subsided. The thermometers were left in the well for thirty-six hours. The heat at this depth was twenty-seven degrees of Reaumur or 92¾ of Fahrenheit, being about twenty-three metres for each degree of temperature. M. Arago expressed a hope that no water might be found for 100 metres more, as in that case there would be a permanent hot spring at the very gates of Paris.

Wooden Paving of Oxford-street.—The extended time allowed by the Marylebone Vestry for testing the durability of various specimens of experimental paving laid down in Oxford-street having expired (on the 3rd of Sept.), a large body of the members of the Experimental Paving Committee proceeded to Oxford-street, for the purpose of entering into a minute inspection of the specimens, prior to completing their final report and recommendation to the vestry as to the plan which it would be most advisable to adopt. The blocks of granite laid down, and the interstices of which are filled up with Claridge's asphalte, was found to be in excellent condition, as was also the granite laid down by the parish and grouted together. The Bastienne gaugac bitumen had stood the test of the wear occasioned by the number of vehicles passing through this extensive thoroughfare in a surprising manner, but at parts where the traffic is most severe here and there, slight ruts are perceptible. On arriving at the wooden blocks the surface was found to be

as smooth and even as when first laid down. Five of the blocks were taken up and minutely examined by the Committee, and one of them split into pieces for the purpose of discovering if any symptoms of decay had made its appearance, but the wood was found to be perfectly sound, and the diminution of the length of the blocks (12 inches), notwithstanding the immense weight of the vehicles continually passing over them, was scarcely perceptible. Having completed their survey of the road the committee adjourned to the Court-house for the purpose of deliberating as to the best mode to be adopted, when a long discussion ensued upon the subject, Mr. Kensett supported the adoption of the wood, and Mr. Harbutt and several others opposed it upon the ground that the material was of too slippery a nature for horses. After a variety of arguments, in the course of which three or four amendments were put and negatived, the following resolution was put and carried—viz. "That it appears to the Committee that the wooden block paving has proved itself equal to the traffic and paring of the whole of Oxford-street, and it is, therefore resolved to recommend to the vestry to adopt the wooden block paving for that thoroughfare, subject to certain conditions and regulations." The greatest interest is manifested on this subject in Marylebone.

Elkington's Patent Mode of Gilding by Immersion.—The ordinary gilding process is well known. An amalgam is formed by rubbing together gold in a comminuted state, and quicksilver. With this amalgam the article to be gilt is covered, and being then exposed to heat, the mercury exhales, and the pellicle of gold remains. The mercurial vapour is condensed, and, thus recovered, is again and again applied to use. By the new process, the gold is dissolved in what the older chemists used to denominate *aqua regia*, with which is mixed one of the combinations of potash. The solution is heated, in order, we suppose, that it may suspend a greater quantity of metal than it would do if cold. At the model room a small spirit lamp was used for the purpose. The copper, or other article, is cleaned by successive washings in acids of diminishing strength, and, lastly, in pure water; it is then dipped in the saturated solution for a few seconds, again washed, as before, and in half a minute the entire process is over, and it is presented to the spectator, beautifully gilt. The gold is deposited on the same principle that crystals shoot upon a rod or string. For single gilding one dipping is required; when a thicker coat is necessary, the dipping and rinsing is repeated.

Steam Naval Resources of England.—A steamer of very large tonnage was lately launched from Chatham dock-yard. It was begun and finished within the incredibly short space of eight weeks. We are informed that this extreme expedition is an experiment under the direction of government, in order to ascertain the shortest possible time in which such a vessel can be completed. The number of hands have been unlimited; in fact, they were working on her as thick as bees in a hive, and allowed to make as many working hours per day as they could. The sum apportioned for the labour, we understand, was four thousand pounds; and should it not cost that, the overplus is to be divided among the men. The experiment has excited the greatest interest in the neighbourhood.—*Greenwich Gazette.*

Artificial Granite Road.—A short time since a new pathway was laid down in that part of Bird Cage-walk just at Storey's Gate, and fronting the late residence of the Hon. Mrs. Norton. The material composing the pathway is a new invention, styled —"artificial granite," and a "mineral animal and vegetable combination. The process adopted in laying it down is similar to that of the asphalte, the composition being poured out boiling hot upon the loose gravel, with which it amalgamates. A few minutes suffice to make the composition quite cold, and as hard as the hardest stone. The appearance of that part of the pathway already finished is that of a finely polished and black block of marble. It is said to be impervious to wet, will not be affected by the sun like the asphalte, and its durability is even greater than marble itself, which has been proved from the fact that a rough piece of marble or granite can be rubbed perfectly smooth on a block of this composition without apparently wearing the latter. Its hardness may be judged from the following test:—A block about five feet by three, and two inches in thickness, was struck for several minutes with heavy sledge hammers by the workmen, and it failed to break; whereas marble, granite, or any other stone, would have flown to pieces. This composition is the invention of M. d'Harcourt, a French gentleman, who is laying down the above-mentioned pathway by order of the Commissioners of Woods and Forests, who intend, should the experiment succeed, to have the whole length of Bird Cage-walk done in a similar manner, as also the parade in front of the new Palace.—*Engineers' and Surveyors' Magazine.*

Gas-water Manure.—A Penzance correspondent of the *Mark Lane Express*, communicates the results of an experiment with gas water—the water in which the street gas has been cleansed. He says he was inclined to try it on a piece of barley land; a quarter of an acre was taken in the middle of a field, or rather a close soil in a granite district; the land was of average quality; the gas water was distributed over the quarter acre by a contrivance resembling a common watering cart, and at the rate of 400 gallons to the acre, about a week before seed time; the rest of the field was manured in the usual way; the difference, both in colour and vigour of the barley plant was so much in favour of the part manured with gas water, that persons passing within view of the field almost invariably came to inquire the cause; the yield also was superior, as well as the after pasture, the field having been laid down with the barley. It might be poured on manure heaps, when it would probably destroy grubs, &c., in addition to its fertile properties.

Tunnel through the Alps.—M. Vanino Volta, the engineer of Como, who, in conjunction with M. Bruschetti of Milan, obtained in 1837, from the Austrian Government, a privilege of fifty years for the construction of a railroad between Milan and Como, is now negociating with the Swiss Cantons of Grisons and St. Gall, an enterprise which would vie in magnitude with the Thames Tunnel, viz., the piercing through the Grisons Alps. Impressed with the commercial importance of the passage of the Spluzen, and at the same time, with the various obstacles which it presents, he thinks it possible to pierce through that mountain and establish in the passage thus effected a railroad, the northern portion of which would end, either at Wallenstadt, or even at Schomerckon, on the lake of Zurich, and the southern should be connected with the Comor and Milan railroad. M. Volta reckoning that thirty years will be required to execute the works, demands an exclusive privilege of a hundred years with liberty to establish companies, in order to procure funds, or to transfer his privilege to other parties.

MECHANICS' MAGAZINE, VOL. XXXI, will be published on the 1st of October, price, in half-cloth, 8s. 6d., embellished with a portrait, engraved on steel, by W. Roffe, from a miniature by Chalon, of the late WILLIAM JAMES, ESQ., the Projector of the Railway System. Also, the SUPPLEMENT TO VOL. XXXI, containing Title, Index, Lists of Patents, and Portrait, Price 6d. COMPLETE SETS of the MECHANICS' MAGAZINE, thirty-one volumes, Price £13 1s.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 842.] SATURDAY, SEPTEMBER 28, 1839. [Price 3d.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

DAGUERRE'S APPARATUS FOR PHOTOGENIC DRAWING.

Fig. 1

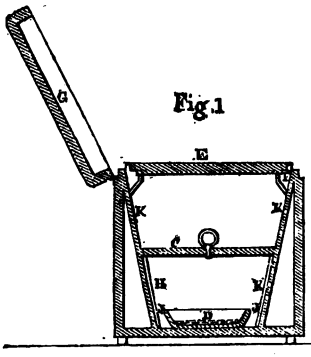
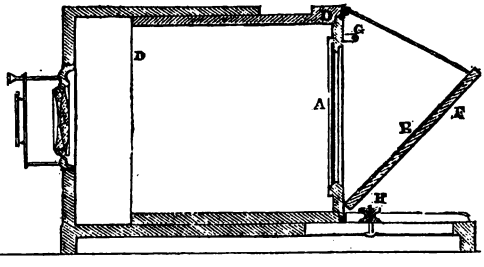


Fig. 6.



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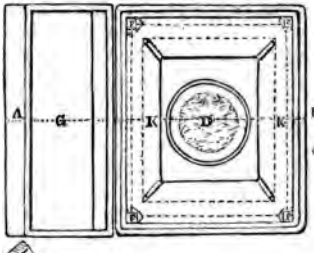
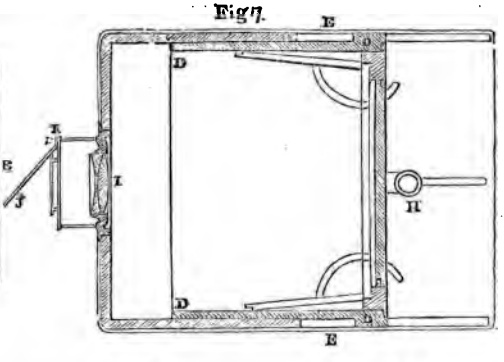
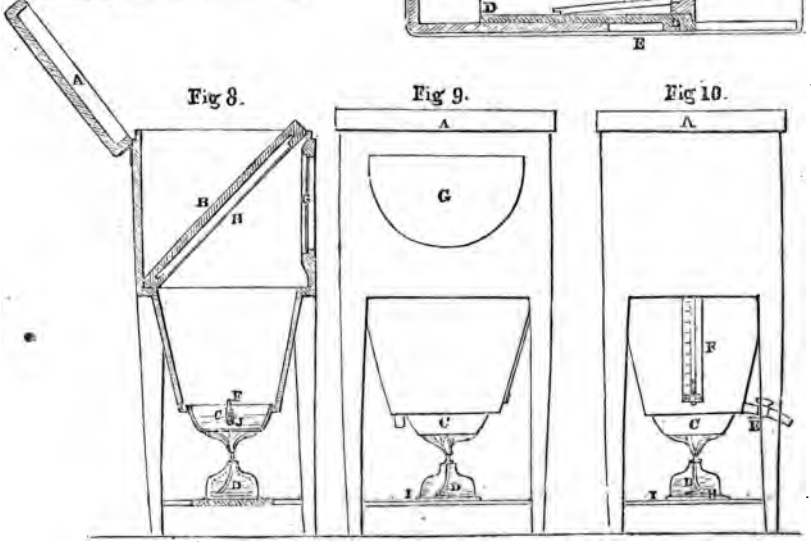


Fig 7.





DAGUERRE'S PROCESS OF PRODUCING PHOTOGENIC DRAWINGS — AND DESCRIPTION OF THE NECESSARY APPARATUS.

[*Abridged translation of M. Daguerre's own description, published by order of the French Government.*]

The pictures are executed upon copper covered with a thin plating of silver. Although the copper serves principally to support the silver foil, the combination of the two metals tends to the perfection of the effect. The thickness of the copper ought to be sufficient to maintain the perfect smoothness and flatness of the plate, so that the images may not be distorted by its warping; but unnecessary bulk is to be avoided on account of weight. The two metals united ought not to be thicker than a stout card.

The process is divided into five operations.

The first consists in polishing and cleaning the plate, in order to prepare it for receiving the sensitive coating, upon which the light produces the picture.

The second is to apply this coating.

The third is the placing the prepared plate properly in the camera obscura to receive the action of light.

The fourth is to bring out the image, which previously is not visible.

The fifth and last operation removes the sensitive coating on which the picture is first impressed, otherwise this coating would continue to be affected by the light, which would necessarily and quickly destroy the picture.

First Operation—Preparing the Plate.—We begin by polishing the plate carefully. To accomplish this the surface of the silver is powdered all over with impalpably powdered pumice, by shaking it from a muslin bag, over, but without touching the plate. The mortar employed for preparing the pumice must be of porphyry; and after it has been ground in the mortar it is to be finished by grinding upon polished glass with a glass muller and very pure water. And lastly, it must be perfectly dried. It is of great importance to attend to these directions, since upon the high polish of the silver depends in a great measure the beauty of the future design.

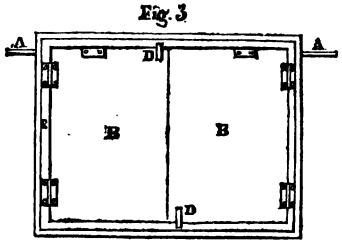
Next, with some cotton dipped in a little olive oil, the operator rubs the *plate gently*, rounding his strokes, beginning from about the centre. During this operation, the plate must be laid flat upon several folds of paper, care being taken to renew these from time to time that the tablet be not twisted from any inequality in the support. The pumice must be renewed and the cotton changed several times. When the plate is well polished, it must next be cleaned by powdering it all over once more with pumice, and rubbing with dry cotton, always rounding and crossing the strokes, for it is impossible to obtain a true surface by any other motion of the hand. A little cotton is now rolled up and moistened with the diluted acid already mentioned, by applying the cotton to the mouth of the phial and inverting it, pressing gently, so that the centre only of the cotton be wetted, and but slightly. The surface of the plate is now rubbed *equally* all over with the acid. Change the cotton and keep rubbing, rounding as before, that the acid may be equally spread, yet in so small a quantity as just to skim the surface. If, as frequently happens, the acid run into small drops from the high polish, change the cotton repeatedly and break down the globules as quickly as possible, but always gently rubbing, for if allowed to rest or to run upon the plate they will leave stains. It will be seen when the acid has been properly diffused, from the appearance of a thin veil spread regularly over the whole surface of the plate. Once more powder over with pumice, and clean it with fresh cotton, rubbing as before, but very slightly.

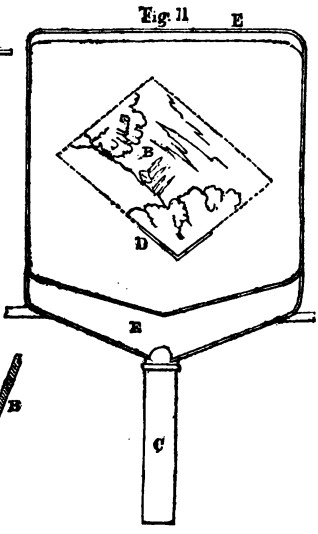
The plate is now to be subjected to a strong heat. It is placed upon a wire frame (made so as to support it above a spirit lamp,) the silver upwards. The spirit lamp is applied below, moving it round with the hand, the flame touching and playing upon the copper. This operation being continued at least five minutes, a white strong coating is formed all over the surface of the silver, if the lamp has been made to traverse with proper regularity. A fire of charcoal may be used instead of the lamp, and is perhaps preferable, the operation being sooner completed. The plate may then be held by one corner with pincers over the fire, moving it at the same time till all is equally heated, and the veil appear as before described. The plate is now to be cooled *suddenly*, by placing it on a

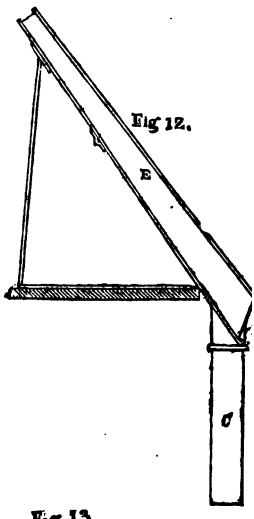
cold substance, such as a mass of metal or stone, or best of all, a marble table. When perfectly cold, it is to be again polished, an operation speedily performed, since the gummy appearance merely has to be removed, which is done by the dry pumice and cotton repeated several times, changing the cotton frequently. The polishing being thus completed, the operation of the acid is to be repeated three different times, dry pumice being powdered over the plate each time, and polished off very gently with the cotton, which must be very clean; care being taken not to breathe upon the plate or to touch it with the fingers, or even with the cotton upon which the fingers have rested, for the slightest stain upon the surface of the plate will be a defect in the drawing.

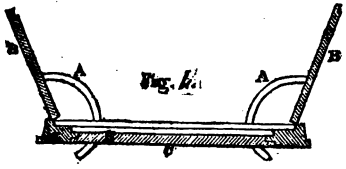
When the plate is not intended for immediate use, the last operation is not performed. Thus, any number of plates may be kept prepared up to the last operation. It is, however, indispensable that a last operation by acid as described, be performed on every plate, immediately before it be placed in the camera.

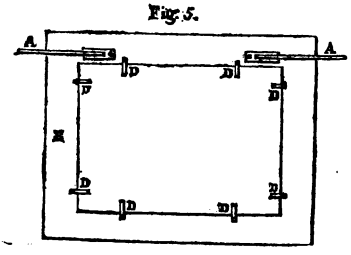
Second Operation—Coating the Plate.—The plate is first to be fixed upon the board, fig. 13, by means of the metallic bands with their small catches and pegs, as represented. Iodine is now put into the little dish, D, at the bottom of the

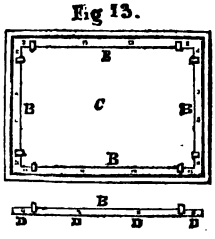












box, figs. 1 and 2 (front page). It is necessary to break the iodine into small pieces, in order to render the exhalation therefrom the more equally diffused, otherwise it would form circles on the plate. The cup containing it ought to be covered with a piece of gauze stretched on a ring. The gauze diffuses the vapours and regulates the evaporation of the iodine, and also prevents the sud-

den compression of the air on the lid being shut, scattering the particles of iodine, some of which reaching the plate, would leave large stains on the coating. The board is now placed in the box, the plate face downwards, the whole being supported by small brackets projecting from the four corners of the box; the lid G, is then closed. In this position the apparatus is to remain till the vaporization of the iodine has condensed upon the plate, sufficiently to cover its surface with a fine coating of a yellow gold colour.

If the plate be suffered to remain over the iodine too long, the gold colour passes into violet, and in this state the coating is not so sensitive to the impressions of light: on the contrary, if not long enough, the coating will be too pale, and will not produce a good picture. A decided gold colour is the only assurance that the ground is properly prepared. The time for this cannot be determined, because it depends upon several circumstances. Of these the two principal are the temperature of the apartment, and the state of the apparatus. The effect should be produced entirely by the spontaneous evaporation of the iodine by the temperature of the room in which the operation is performed. It is also very important that the temperature of the inside of the box be the same as that of the air outside, for otherwise, a deposition of moisture will take place upon the plate, a circumstance detrimental to the final result. The oftener the apparatus has been used, the less time is required, because the interior of the box being impregnated with the vapours of iodine, these evolve from all sides, and condense more equally and rapidly upon the surface of the plate. It is therefore proper to leave always a small quantity of iodine in the cup, and to protect it from damp. An apparatus which has been some time in use, is thus preferable to a new box.

The time may vary from five minutes to half an hour, rarely more, unless the weather be cold. Means must be adopted for examining the plate from time to time, and in these examinations the light must not fall directly upon the plate. When the operator desires to inspect it, he raises the lid of the box, and lifting the board with both hands, turns up the *plate quickly; a momentary glance and very little light suffices.* If it appear that the colour is deeper on one portion of the plate than on another, to equalize the coating the plate must be replaced, turning it one quarter round at each inspection. The process must be conducted in a darkened apartment into which the light is admitted side-ways, never from the roof—the door left a little ajar answers best. If too pale, the plate must be instantly replaced, till it attain the proper gold tone; but if this tint be passed, the coating is useless, and the operations must be repeated from the commencement.

When the coating has reached the proper colour, the plate with the board to which it is fixed, is slipped into the frame (figs. 3, 4 and 5) and adjusted at once in the camera. In this transfer care must be taken to protect the plate from the light; a taper should be used, and even this with precaution; as a taper light will leave traces of its action if continued for any length of time.

The third operation, that of the camera, should *immediately* succeed the second, the longest interval ought not to exceed an hour. Beyond this space the action of the iodine and silver is no longer effective.

Third Operation—The Camera.—This third operation is that in which by means of light, acting through the camera, an image is impressed on the photographic plate. This operation, being accomplished only through the agency of light, will be the more rapid, in proportion as the objects to be delineated stand exposed to a strong illumination, or naturally present prominent and bright lines and surfaces.

The adjustment of the camera to obtain a good view being made with satisfactory precision, the obscured glass is to be withdrawn, and its place is supplied by the apparatus with the plate attached, as already described, secured by small screws. The light is of course all this time excluded by the inner doors; these are now opened by means of two semicircles (see figures), and the plate is disposed to receive its impression.

To determine the time necessary to effect the desired object is a task of some nicety, because nothing is visible; and the photogenic effect depends entirely on the intensity of the light on the objects, the appearance of which is to be produced. At Paris, for example, this varies from three to thirty minutes.

The seasons, as well as the hour of the day, have considerable influence on the operation. The most favourable time is from seven to three o'clock; and a drawing which, in the months of June and July at Paris, may be taken in three or four minutes, will require five or six in May or August, seven or eight in April and September, and so on in proportion to the progress of the season. These are only general data for very bright or strongly illuminated objects, for it often happens that twenty minutes are necessary in the most favourable months, when the objects are entirely in the shadow. The latitude is of course a fixed element in this calculation. In the south of France, for example, and generally in all those countries in which light has great intensity, as Spain, Italy, &c., we can easily understand that these designs must be obtained with greater promptitude than in more northern regions. Practice is the only sure guide. It is, however, very important not to exceed the time necessary, in different circumstances, for producing a picture, because, in that case, the lights in the drawing will not be clear, but will be blackened by too-prolonged solarization. If, on the contrary, the time has been too short, the sketch will be very vague, and without the proper details.

Immediately the plate is withdrawn from the camera, it should be subjected to the next process; there ought, at most, not to be a longer interval allowed to elapse than an hour, between the third and fourth operations.

Fourth Operation—Mercurial or Disengaging Process.—By means of a funnel the mercury is poured into the cup C at the bottom of the larger vessel in the apparatus, figs. 8, 9, and 10, sufficiently to cover the bulb of a thermometer F. Afterwards, and throughout the remaining operations, no light save that of a taper must be used.

The board with the plate affixed is now to be withdrawn from the camera frame, and placed within the ledges of the black iron stand or vessel (figs. 8, 9, and 10), at an angle of 45°, the tablet with sketch downwards. It can be seen and examined through the glass G. The top A is then gently put down, so as not to raise up particles of the mercury.

The spirit lamp is to be lighted, and placed under the cup containing mercury, and allowed to continue till the thermometer, the bulb of which is covered by the mercury, indicates a temperature of 60° centigrade. The lamp is then immediately withdrawn; if the thermometer has risen rapidly, it will continue to rise without the aid of the lamp, but this elevation ought not to exceed 75° centigrade.

In a few minutes the faint tracery of objects begins to appear, as may be seen by looking through the glass G, by the light of a taper, using it cautiously, that its rays may not fall upon the plate. The operation is continued till the thermometer sinks to 45° centigrade; the plate is then withdrawn.

When the objects have been strongly illuminated, or when the action in the camera has been continued rather too long, this fourth operation is completed before the thermometer has fallen even to 55° centigrade. This may be known by observing the sketch through the glass.

The sketch may now be examined by a feeble light in order to be certain that the processes hitherto have succeeded. The plate is now detached from the board. The performance of the fifth and last operation may be deferred if not convenient; for the sketch may now be kept for months without alteration, provided it be not too frequently inspected by daylight.

Fifth Operation—Fixing the Impression.—The object of this process is to remove from the tablet the coating of iodine, which continuing to decompose by light the picture would otherwise be speedily destroyed.

One quarter of common salt and three-fourths of pure water (in bulk) is put into a bottle and shaken, and the saturated solution thus made is to be filtered through paper. Instead of the solution of salt one of hyposulphate of soda may be used, and is even preferable, because it removes the iodine entirely, which the saline solution does not always accomplish, especially when the sketches have been laid aside for some time between the fourth and fifth operations. It does not require to be warmed, and a less quantity is required.

Pour the solution into a square shallow trough of copper provided for the purpose, filling it to the height of an inch; pour water into another similar trough.

The plate is first to be plunged and withdrawn immediately from the water—the surface merely requiring to be moistened—then into the saline solution. The plate is moved about in saline solution by means of a little hoop of copper wire. When the yellow colour has been quite removed, the plate is lifted out with both hands, care being taken not to touch the drawing, and plunged again into the trough of pure water.

The plate on being withdrawn from the trough is instantly placed upon the inclined planes (figs. 11, 12); distilled water, hot but not boiling, is made to flow in a stream over its whole surface, carrying away every remaining portion of the saline wash. If hyposulphate has been used, the distilled water need not be so hot as when common salt has been employed.

About a quart of distilled water is required. The drops of water remaining on the plate must be removed by forcibly blowing upon it, otherwise in drying they would leave stains on the drawing. Very pure water should be used. To be assured of the purity of the water, let a drop fall upon a piece of polished metal; evaporate by heat, and if no stain be left the water is pure, Distilled water is always sufficiently pure without this trial.

After this washing the drawing is finished, it remains only to preserve it from the dust, and from vapours that might tarnish the silver. The mercury, by the action of which the images are rendered visible, is partially decomposed; it resists washing, by adhesion to the silver, but will not endure the slightest rubbing.

To preserve the sketches thus made, place them in squares of strong pasteboard, with a glass over them, and frame the whole in wood. They are thenceforth unalterable even by the sun's light.

The same plate may be employed for several successive trials, provided the silver be not polished through to the copper. But it is very important after each trial to remove the mercury immediately, by using the pumice powder with oil, and changing the cotton frequently during the operation. If this be neglected, the mercury adheres to the silver, and fine drawings cannot be obtained if the amalgam be present. They always in this case want firmness, neatness, and vigour of outline and general effect.

Description of the Engravings.

Fig. 1 is a section of the box for submitting the plate to the vapour of iodine, used in the second operation, down the middle of the apparatus by the line A B, of fig. 2, which is a plan; C is a lid, which fits accurately the interior, dividing the whole into two chambers. It is closed at all times, except when the operator is actually employed in coating the tablet. Its use is to concentrate the vapour of the iodine, and preserve the whole in a state for equally and rapidly diffusing the vapour, when the plate has been introduced. D is the cup in which the iodine is placed. E the small board with the plate attached, face downwards. Four small projecting supports, F, receive the four corners and retain the plate in the most favourable position for receiving the vapour of the iodine as it rises. Of course the cover C is then withdrawn. G is the lid of the box, always shut except when the plate is to be withdrawn for examination. H, supports for C. K, tapering sides all round, forming a funnel-shaped box within the other; the funnel-shaped interior diffuses the vapours of iodine, which thus spread as they rise. A circle of gauze is stretched over a ring, and placed upon the cup with the iodine. The vapour of which rising through this light covering, flows up equally, and not in clouds; the gauze also prevents the particles of this substance from flying about, and probably injuring the plate.

Figs. 3, 4, and 5, (p. 467) are three views of the frame into which the plate with its wooden tablet is put, on removal from the iodine process. The object of the apparatus is twofold—to adapt the plate to the camera obscura, and to protect the iodine coating from the action of light till the moment in which it receives the focal image. A, half circles which open and shut the doors B B; C, fig. 5, the plate with its wooden tablet fitted into the frame; back view of the plate fronting inwards, the door shut upon it; D screws to fix the tablet and plate, and to stop the doors; E thickness of the frame; F, fig. 4, plate: the whole represents the arrangement for receiving the photogenic impressions on the plate; the doors being open, the focal image

falls upon the prepared plate, and leaves its impress pencilled there by the rays of light proceeding from the natural objects.

Fig. 6, perpendicular longitudinal section of the camera obscura, as adapted to photogenic delineation. A, a ground glass by which the focus is adjusted. It is then removed, and the photographic plate substituted, as in C, fig. 7; B, a mirror for observing the effect of objects, and selecting points of view. For these purposes it is inclined at an angle of 45°, by means of the support L. To adjust the focus, the mirror is put down altogether, and the ground glass A used. The focus is easily adjusted by means of one part of the box D D silding within the other E E, as represented in the figures; when the focus is adjusted the box is fixed in position by the screw H. The mirror is retained in its place by hooks at F, which take into the eyes at G.

This instrument has the disadvantage of reversing the objects; but this can be easily obviated by substituting another mirror outside, as K J, fig. 7. This arrangement, however, injures the effect on the photographic plate from the loss of light. It increases the time of the operation by one-third of the whole.

Figs. 8, 9, and 10, are three views of the apparatus, used for the fourth operation,—submitting the plate to the vapour of mercury; fig. 8 is a section of the apparatus; fig. 9 front view of the same; fig. 10 the side in which the thermometer is placed; A, lid of the apparatus; B, back board with grooves to receive the small board and plate; C cup containing mercury; D, lamp with spirit of wine; E, small cock inserted obliquely, through which the mercury is withdrawn after the operation; F, thermometer; G, glass through which to inspect the operation; H, tablet with the plate as removed from the camera; I, stand for the spirit lamp, which is placed within the ring N, so as to be under the centre of the cup. All the interior of this apparatus should be black and varnished.

Figs. 11 and 12 represent the apparatus for the operation of washing the plate.

This apparatus is made of japanned white iron or tin; E, well for receiving the water that flows through the tube C, Fig. 13, the board or wooden tablet upon which the plate is fixed for the purpose of undergoing the operations after the first one of polishing. It is fastened by means of the ledges, B B B B, to each of which are soldered two small projecting pieces or ears, these embrace the plate near the corners, and it is retained in position by small pegs, or better, screws through holes in the ledges, inserted by a handle or turn-screw. The purpose of the ledges is not solely to fix the plate, their more important use is to serve as a kind of frame to it, while undergoing the second process, the application of the iodine: without these the coating of iodine would not be equally diffused, for the vapour would condense more rapidly along the edges, and consequently, the coating would be too thin in the centre and too thick round the circumference.

THE "BRITISH QUEEN" AND "GREAT WESTERN"—MR. HALL'S CONDENSERS.

Magna est veritas et prevalebit.

Sir,—I appeal to you, whether in my *trashy* attempt to run down the engines of the *Great Western*, I have at all acted on the offensive;—whether I have done more than acting merely on the defensive? I contend that I have not stated a word more about the breaking of the frame-work and other injuries to the engines of the *Great Western* than was necessary to contradict the unfair comparison made between them and those of the *British Queen*. The warfare between the London and Scotch engineers was not commenced by me but by Mr. "Piston" *cum* "Observator." If what I have stated about the *Great Western* be untrue, why does "Piston," (to use his elegant phraseology) *shirk* the matter? Why does he not contradict me by stating that the framings of her engines are *not* broken in many places, that the cylinders and pistons are *not* galled nor furrowed, and that the boilers are not injured?

I hope that "Piston" will, in his future communications, confine himself to fair fighting, and use no foul play, or, in other words, that he will speak the truth, which I will prove to you he has, in many instances, violated, during his

combat with Mr. H., who, *poor man*, seems to have attracted all the thunder and lightning from the dread Mr. "Piston," and has diverted it not only away from me, but from all the Scotch engines and Scotch engineers. We ought *en passant* all to praise so good a conductor of the electric or *pistonic* fluid, by which we are, perhaps, saved from annihilation.

I venture to thank "Piston," on Mr. Hall's behalf, for the seven further advantages of the patent condensers, which are added to those enumerated by Mr. Hall.

In answer to the 11th and 12th, I say that it is untrue, that the additional expense of engines with his condensers, is so great as is stated, unless the engines have both the improved and the common condensers; but admitting, for argument's sake, that "Piston" has not exaggerated the additional expense, I will undertake to prove, to any competent scientific men, (except boiler makers and others who are interested in the rapid destruction of boilers and engines) that the immediate and consequential advantages and economy of Mr. Hall's condensers, will repay the additional expenses, inclusive of (to use "Piston's" witty expression) *my* patent right, within the first eighteen months, taking the average of ten or twelve years as the datum to calculate upon, within which period boilers supplied with salt and dirty water must be replaced three or four times.

Mr. "Piston's" 13th article is principally an attack upon Mr. Hall's principle of distillation, the rest being "all but leather and prunella." Now I assert that his principle of distilling *in vacuo*, whereby a large quantity of pure water can be produced without the application of any fire to the still, but merely by the heat of boiling water, is a most beautiful and scientific invention, of which he has reason to be proud. In article 14th, "Piston" speaks of the multiplication of pipes and cocks in the engine-room; I presume he means the pipes and cocks connecting the small vessel constituting the still, with the condenser whereby the distillation in vacuo is effected, the operation being stopped or commenced by the simple shutting or opening of such cocks; let any person examine this beautiful process, and I have no doubt but he will be of my opinion respecting its merit. But "Piston" should (joking apart) be candid; he should tell you that the use of more cocks and apparatus is done away with by these condensers than is added by them; for instance, the use of injection cocks, of the blow-out cocks, of the pumps and apparatus for feeding the boiler is done away with, and the brass linings of the air pumps and brass buckets and rods are unnecessary, on account of none but pure distilled water and a little oil entering into them. "Piston" states as follows:—"Of the multiplication of cocks and pipes in the engine-room to such an extent that a previous six months education at Basford is necessary to enable the engine-men to comprehend their nature and working." Now, I have no hesitation in stating that this is a mis-statement altogether. I have made the needful inquiries and am informed that not a single engineer aboard any of the many vessels to which Mr. Hall's condensers are applied ever was at Basford at all. I beg to refer Mr. "Piston" to the motto of this letter.

In answer to "Piston's" witticisms respecting Mr. Hall's method of cleansing the pipes, if ever necessary, (which, indeed, is seldom the case) I say that, like his distillation *in vacuo*, it is a most beautiful process, for if the pipes were not clean they can be rendered as perfectly so as when they were first put in, in a quarter of an hour, and that without stopping the engines; this is done by injecting into the top of the condenser, (through a half-inch pipe) a few gallons of solution of potash, which rushes through the pipes and cleans them perfectly; these few gallons are not sent into the boiler but are allowed to escape into the bilge. These things, at which "Piston" sneers, render the invention complete; Mr. Hall has perhaps as much merit from them, and from the practical management of his apparatus, as for his invention itself.

I really wish, Mr. Editor, that you could see this process, and that of the distillation *in vacuo*; I assure you you would be delighted with them, and be enabled to judge of the amount of "Piston's" disingenuousness.

In answer to "Piston's" statement respecting the additional weight of the patent condensers, I assert that it is grossly exaggerated, unless he means such en-

gines as have both the patent and the common condensers. The difference in weight in question I am assured by a highly respectable manufacturer of marine engines is too trifling to be deserving of the least consideration.

With respect to "Piston's" 17th and last article, it really does him no credit as a scientific man and an engineer. He states that the mixture of condensed steam and injection water as they come from the injection engine is 90° or 100° of temperature. I think it will seldom be found lower than 120°; however, suppose it to be 115°. Mr. Dalton's tables show that a vapour will result from it, capable of supporting a column of mercury of three inches; now the temperature at which the water resulting from the condensation of the steam is intended to be reduced by Hall's condensers is about 70°, which will not support a column of quite three-quarters of an inch of mercury; thus, while by this very circumstance, common condensers lose three inches of their vacuum, the patent ones lose only three-quarters of an inch, or, in other words, the latter produce a vacuum two and a quarter inches more perfect than the former, which, I may remark, is further injured by the air contained in the injection water, and by it introduced into the condenser; as to the fuel required to heat water from 70° to 115°, it is an infinitesemal of the lowest order, and too trifling to be put in the scale against the improvement in the vacuum.

"Piston" says, in conclusion, "I might go on, Mr. Editor, adding to the above list of advantages," &c. Were I Mr. Hall, I should feel much obliged to him to do so, for his condensers are too perfect, as proved by long experience, to be injured by any attempted misrepresentation. I repeat that, *Magna est veritas et prevalebit.*

I am, Sir,
Yours respectfully,
PISTON-ROD IN PICKLE.*

We have taken the liberty of omitting so much of "Piston-rod in Pickle's" letter, as refers to the testimonials with which Mr. Hall has been favoured of the working of his system of condensation, because, on further consideration, we have thought it right to accede to Mr. Hall's request to publish the testimonials themselves, which will be found in the next article. We have received communications from other correspondents, upon this subject, so long and fierce, on both sides of the question, that we think it will give perfect fair play to both parties and to our readers, to allow of one letter more from each writer already in the field, and then to let the matter drop, until new facts, and further experience, shall call for publication.—Ed. M. M.]

MR. SAMUEL HALL'S PATENT CONDENSER.

Sir,—You will oblige me by inserting in your Magazine the following testimonials respecting my patent condensers, from Mr. Peterson, chief engineer on board the *British Queen*, and formerly chief engineer on board Her Majesty's steam-ship, the *Megæra;* also an extract from a letter from Messrs. Taylor and Eyres, the present chief, and second engineers on board that vessel. The mercurial barometers applied to her engines were made by Mr. Bedwell, of Ailie-street, and are well known and much used both in the Thames and the Clyde. These documents form the best answer to the attacks made upon my patent condensers in your Magazine.

I am, Sir,
Your obedient servant,
SAMUEL HALL.

18, King's Arms-yard, Sep. 2, 1839.

"Sheerness, Feb. 13, 1838.

"I hereby certify that we got a vacuum of 30½ in. of mercury in the engines with Mr. Samuel Hall's patent improvements, on board of Her Majesty's steam-vessel, the *Megæra.*

"EDWARD PETERSON.
"Engineer to the *Megæra.*"

"London, March 22, 1839.

"Dear Sir,—According to your request I send you the following testimonial in favour of your patent condensers, which I do with much pleasure.

"As I have had considerable experience in steam-vessels on the common plan, I have, on that account, been better able fully to ascertain the great advantages of your invention, while on board H. M. S. *Megæra*, in the Mediterranean, and I can assure you that after having run a distance of 25,000 miles, her boilers were as clean and as perfect as the first day we started, which is fully proved by the vessel going out again to the Mediterranean with her boilers untouched. Also the working parts of the engines were preserved in the same good order, from the absence of all the evils arising from using salt instead of distilled water. I showed the valve faces, pistons, cylinders, piston-rods, &c., to many experienced engineers, who were all of the opinion that had the engines been working with the common condensers it would have been impossible they could have been in such excellent order. I

may also add that the great ease and security your patent engines give to the persons in charge in bad or variable weather is of no small importance.

"But as it is not my intention to enumerate *all* the advantages of your engines in this letter, but only to bear witness to their excellence generally, I will conclude by observing that I think the advantages derived from your condensers are such, that no vessel ought to go to sea without them, and

"I am, Dear Sir,

"Yours respectfully,

"EDWARD PETERSON.

"Late chief engineer of H.M.S.V. *Megæra*.

"Samuel Hall, Esq."

Extract from a letter received by Mr. Joseph Stubbs, foreman to Messrs. Seawards and Co., from Messrs. Taylor and Eyres, engineers of Her Majesty's steamship, the *Megæra*, with Samuel Hall's patent condensers applied to her engines.

"Gibraltar, July 17, 1839.

"Mr. Stubbs,

"Sir,—I know you will be anxious to know how we are getting on with the machinery of the *Megæra*. Every thing is as good as when first she started; we have never had to clean the boilers since we left England. The distills work very well, and the water in the boilers is perfectly fresh and not the least appearance of salt about them, and the condensers are as tight as a bottle. We never miss a trip but are always the 'ready coach.' The distill does not require to be worked above one-third of the time that the steam is up, and everything is perfectly sound.

We remain, Sir,

Your obedient, humble servants,

(Signed) J. TAYLOR, R. EYRES, } Engineers of the *Megæra*.

BIOGRAPHICAL NOTICE OF WILLIAM JAMES, ESQ.,
PROJECTOR OF THE RAILWAY SYSTEM IN ENGLAND.

[*Communicated by one of his Relations.*]

The subject of the following memoir claims our attention and respect as one of those whose genius and persevering efforts have produced incalculable benefits to his country. In this enlightened age, we have no doubt that the merits of this gentleman, when they are more generally known, will be fully acknowledged and appreciated; and we hope that this brief sketch of his life will have the effect of raising in the public mind a sense of the benefits that his great exertions have conferred upon society at large. As is, unfortunately, too often the case, the services of this "forlorn hope" of the railway contest have been overlooked in the bestowal of honours and plaudits upon his successful followers. Justice has, certainly, not been done to his memory by those who have, and are at present, reaping a rich harvest from his exertions.

We proceed to the pleasurable task of describing and briefly mentioning some of Mr. James's executed and projected public works—emanations evidently of no common genius—together with a few particulars of his life and connections.

William James (born 13th June, 1771) was the son of a gentleman bearing the same name, a highly respectable solicitor and man of fortune, residing at Henley-in-Arden, in Warwickshire, whose father married an heiress of the name of Butler (a branch of the Ormond family) residing at Linsworth Hall, county of Worcester. Mr. James was educated at Warwick and Winson-green schools, and at an early period of his life evinced talents of a superior order. He was brought up to the law, and studied in London. During the period of his studies he attended with great relish various debating societies, by which he acquired considerable oratorical powers; these he displayed frequently in after life, and they materially tended to his advancement and usefulness. At the age of twenty-five he married the orphan daughter of Mr. Wm. Tarlton, of Botley. He then commenced business for himself at Henley-in-Arden. His father having lost the bulk of his property by speculations in Worcester and other canal shares, rendered attention to business the more necessary to success on the part of the son; being, however, fond of company and field sports, and connected with a freemason's lodge, of which he was the master, occupations which, of course, engrossed much of his time, he did not make much progress in business, while residing at Henley. He removed to the village of Wellsbourne, having undertaken the management of a Mr. Dews's estates, and his attention being undistracted he now entered spiritedly into the business of land agency. By the exertion of a natural energy and perseverance, he soon became eminent in his profession. Finding the situation of his present abode inconvenient for the ma-

nagement of the Warwick estate, to which he had been appointed agent and receiver, he removed to St. John's, Warwick, where he immediately acquired an immense increase of business.

At this time, (about 1804) in consequence of the threatened invasion of this country by Bonaparte, he organized the Warwick volunteers, at a great expense to himself. He held the commission of Major in this corps, and notwithstanding his own business engagements, he never neglected his military duty. At the disbanding of the corps, he was presented by his brother officers with a sword of one hundred guineas value, with a suitable inscription in testimony of their respect, and consideration for his services. It was a common practice with him, after the day's military duty, to mount his horse and ride off to his mines in Staffordshire, a distance of 30 miles, and be back again to exercise in the morning. Indeed his exertions at this period, and for many years subsequently, were of the most extraordinary kind, and such as few constitutions could undergo; —travelling post generally two or three nights in the week, to and from various distant parts of the kingdom, and without any care or regularity in his mode of living; nothing indeed seemed to affect either his health or spirits.

Mr. James projected, in 1804, the drainage of Lambeth Marsh which he surveyed and levelled by the direction of the late Prince of Wales and Archbishop of Canterbury; Waterloo Bridge formed a part of this plan, although not precisely in the situation of the present structure, his terminus on the Middlesex side facing Southampton-street, Covent Garden, and a proposed new street running into Tottenham Court-road. He likewise projected and surveyed, at his own expense, a new line of turnpike road from Warwick, through Buckingham, to London, and was the first person to open the West Bromwich coal-field in Staffordshire, where in conjunction with Mr. Vansittart and others, he established at an immense outlay the Ballshill and Golden-hill collieries. He was the proprietor of the Wednesbury Old Field Colliery, where he afterwards proved the existence of the lower thin coal measures, which had been previously proved to exist in the neighbourhood of Bilston, by the late Mr. Samuel Faraday. He bought several other collieries about this time, viz.:—the Ocker-hill, Lee-brook, and New Contract Collieries; the Birchill Colliery and Iron Works; the Pitsalt Colliery, Swadlincote Colliery in Derbyshire; Wyken Colliery, near Coventry in Warwickshire; the whole of which he carried on with his own capital. He at the same time had the management, for the late Lord Warwick, of the Clutton mines in Somersetshire, and embarked with the late Lord Whitworth, Duchess of Dorset, Mr. Vansittart and others in a very extensive trial for coals at Benhill in the county of Sussex, in which upwards of 30,000*l.* were expended without success, in consequence of the quantity of water they had to contend with.

Mr. James was, about 1816, connected in several draining-schemes with the late Wm. Elkington, Esq. In 1816, he was elected chairman of the meetings of the coal masters at West Bromwich. Having done so much for the interests of that trade by the discovery of mines, its promotion generally, and by his evidence before Parliament, it was suggested by several capitalists to present him with a suitable acknowledgement of their gratitude; this, however, was declined by him, and the subscription not proceeded with at his desire.

The oppressive conduct of several Canal Companies having caused great complaints from the iron and coal-masters of Staffordshire, a line of country was surveyed and application made to Parliament to grant a Bill for a new canal to pass from the mines and works in Staffordshire down the vale of the Tame to Birmingham. This Bill, however, was given up to the old Birmingham Canal Company, under an assurance that they would prosecute the measure, in order to bring into the market the extensive mines then newly discovered and opened by Mr. James. But this assurance proved a mere delusion; the Bill was brought into the House of Commons avowedly seeking powers for cutting this canal, but the Canal Company afterwards took the earliest opportunity to withdraw all clauses relative thereto, and to introduce other clauses relative to the supplying the old canal with water, and authorizing the purchase of Wood's engines, whereby the public-spirited intentions of Mr. James were frustrated, and his prospects greatly depreciated.

Indignant at having been thus foiled by the Canal Company, and both himself and others suffering considerably from want of communication with the market, Mr. James laid out a line for a rail-road from Wolverhampton to Birmingham, and excavated a large space of ground of which he was lessee at Newhall Hill, adjacent to Birmingham, upon which he formed a series of wharfs, (which are now become of great value;) but the alteration in the currency at that time so materially injured his finances, that these intentions were never carried into effect. Subsequently, however, his plan was partially taken up by some other persons announcing to the public an intended rail-

way from Birmingham to the collieries, and Mr. James was applied to, to determine and survey the line. His intentions were, again however, frustrated, a railway from Birmingham to Liverpool being agreed upon; and Mr. James was summoned to attend the meeting of the iron-masters at Wolverhampton, April 26, 1824, when the subscriptions for this purpose were opened on a capital of 500,000*l.*

Mr. James, during his residence in London, established one of the largest land agency businesses in the kingdom; his principal office was at New Boswell-court, Lincoln's Inn; and there were branch offices in the country. He was agent and receiver to the late Duke of Northumberland, Lord Whitworth, and Duchess of Dorset; Lords Willoughby-de-Broke, Dartmouth, Thurlow; Mr. Vansittart, Miss Plumtree, &c. &c. He was also extensively engaged in business for the late Dukes of Norfolk and Marlborough; Marquis of Headfort, Bishop of Bath and Wells, Lords Clifden, Holland, Spencer, St. John, Donegal, Redesdale, &c. &c., and many of the most wealthy commoners of the country. All these noblemen and gentlemen placed great reliance upon his judgment in respect both to the value and management of mineral as well as landed property.

At the same time he managed these immense estates he projected and carried into effect some of the most important inclosures of waste land in the kingdom; we may mention Hounslow, Isleworth, and Dulwich; and had almost the entire superintendence of the Stratford-upon-Avon canal, which engrossed much of his attention. He was appointed deputy chairman of this Company, being the largest proprietor, having upwards of 20,000*l.* embarked therein. He purchased the principal tonnages of the River Avon from Stratford and Evesham and Tewkesbury, and upon this he expended upwards of 6,000*l.* to render it navigable for barges of considerable tonnage. In a few years, as his property increased, he became himself a very extensive landed proprietor by purchasing the Snowford estate, of nearly 1000 acres, and its manor, in Warwickshire, and the Trebinsion estate in South Wales of about 700 acres; the former he afterwards sold to Lord Aylesford for 57,000*l.* and the latter to Sir William Hamilton for upwards of 20,000*l.* He obtained by degrees a large and very valuable property at Warwick in land and houses. So well had he up to this period prospered, that about the year 1812 he was computed (by his cashier) to be worth upwards of 150,000*l.*, while he *was at the same* time realizing more than *10,000l. per annum* by his profession. *Indeed, long subsequent to* this time, and after he had suffered some severe losses by his mining speculations, having met with an accident which he feared might prove fatal, he made a will bequeathing 50,000*l.* to his eldest son, Mr. W. H. James, and 10,000*l.* to each of his other six children, besides minor legacies. He lived, however, as will afterwards appear, to lose the whole of this wealth.

To give the reader an idea of the extent of his various speculations it will only be necessary to state that he employed upwards of 40 clerks and agents, and nearly 500 workmen, in his different mines, iron and lime works, farms, wharfs, carrying trade, &c.

In these speculative matters he gradually became more and more engaged, thus taking away his attention from his more certain and lucrative business of land agency. He had also to dispose of some of his most valuable property to meet the constant demands that pressed upon him for carrying on his numerous works; every thing, however, appeared to progress favourably till the passing of the Bank Restriction Act, brought forward by Sir R. Peel. The effects of this measure, as is well known, involved many in sudden ruin. The blow fell with particular force upon the miners and ironmasters of Staffordshire, who at all times had been in the habit of speculating and carrying on their business with borrowed capital.

It was at this period that Mr. James principally directed his attention to the subject of railways, in consequence of the great depreciation of his own and other property in consequence of the legislative enactment just mentioned.

He hoped to sustain and revive the mineral and commercial interests, and to arrest or alleviate that ruin and distress which fell upon many men of great talents, industry, and acquirements, and who merited a better fate. Mr. James considered that accelerated locomotion would in a degree compensate for a diminished currency, and that cheap freight would leave more gain for the agriculturist, the manufacturer, and the miner; and consequently that low prices might be made compatible with increased profit. To obtain these results the agency of *steam power* he considered was best adapted, and he therefore proceeded to view the different locomotive carriages as well as the principal railroads in the kingdom. Being convinced by his examination that locomotion by the power of steam could be employed with the utmost safety and advantage in most situations, he now devoted his time exclusively to the determining and surveying of many extensive lines in the northern and midland parts of

the kingdom, and principally at his own expense.

In 1823, Mr. James published the first of twelve Essays on the "Engine Rail Road System," for which he strenuously sought the best data. It contains an exposition of the valuable minerals deposited in or adjacent to the lines marked out, with suggestions for the improvement of the ports of Chester, Preston and Lancaster; also plans for the draining and reclaiming of many extensive salt marshes, as well as for the embanking and recovery from the sea of large tracts of land containing valuable minerals. These plans were accompanied by specifications of several improved locomotive engines, particularly that of Mr. George Stephenson, in the patent for which he became a partner.

In this essay Mr. James advocated the possibility of a velocity being attainable on railways of twenty or thirty miles an hour,—in opposition to the opinions of Messrs. Wood and Stephenson, who thought that railway travelling could not exceed eight or ten miles an hour. He instanced the possibility of bringing up by railway the whole crew, stores and cargo of a man-of-war, from Portsmouth, in one day. With what foresight and judgment he viewed the subject of his labours, we of the present railway age can testify. Mr. James and Mr. Stephenson were both at this time devoted to the railway system, and joined their energies to work it out. They made an agreement to divide the field of their labours,—the kingdom, between them—Mr. James taking all on the south side of a line drawn from Liverpool to Hull, and Mr. Stephenson all on the north; he then vigorously pushed on his operations and proceeded with the surveys of several lines within his province, and amongst others, he completed the survey of the Manchester and Liverpool Railway, which he commenced in the year 1822. Indeed he was now so deeply engaged in railway speculations, that his other affairs languished for want of the requisite attention. He had, no doubt, a brilliant and prosperous course before him, had it not been, as before stated, for the sudden change in the currency and other unforeseen occurrences happening about the same period, which completely altered the state of his affairs and prospects. The clouds which for some time past had only hovered over his head, now burst with unabating violence; the bulk of his large accumulated property having been expended and locked up chiefly in public speculations and improvements, he was unable to meet the calls upon the numerous shares he possessed in canals, &c., as well as the negociable bills due; the consequence was he was declared a bankrupt in 1823. *Thus he was* prevented from completing his grand scheme and the whole fell to Mr. Stephenson, who, with others, reaped the benefit of Mr. James's exertions. Mr. James never after his bankruptcy recovered his former energies, although he went on to the end toiling in the faint and delusive hope of being yet able to leave his family a moderate fortune: the dower of his wife being given up there was not even that resource left.

In introducing and advocating the railway system he found he had to combat with obstacles of no ordinary kind. The cause he had devoted himself to was at first unpopular, and he was met on all sides with ridicule, jealousy and malice; nevertheless, with apostolic energy he laboured on to the end, and had the satisfaction of seeing the great system of which he was the principal author ripen into maturity. Sick at heart, and worn down by his exertions in the service of the public, he wished for retirement, and having married a second time, he settled at Bodmin, in Cornwall. A series of cares, vexations and disappointments, had by this time, however, so exhausted his bodily frame, and the energies of his mind, that he at length sunk under them. He died from exhaustion after an attack of the influenza on the 10th of March, 1837, leaving four sons and two daughters, by his first wife, and a young widow and two infant daughters, without any patrimony whatever. The Liverpool and Manchester Railway Company last year voted the sum of £300 to this lady in consideration of the survey of that line made by her husband.

Mr. James projected and surveyed the following lines of railway, principally at his own expense—and many miles during the latter years of his life, by his own labour:—

1. Manchester and Liverpool, and adjacent lines to Warrington and Bolton.
2. Birmingham and Manchester through Derbyshire.
3. Birmingham and Wolverhampton.
4. London and Birmingham.
5. Moreton in Marsh.
6. Canterbury and Whitstable.
7. Bishop's Stortford, Cambridge and Newmarket.
8. London and Brighton, Portsmouth and Chatham.
9. Bristol, Bath and Bradford.
10. Bristol, Salisbury and Southampton.
11. Padstow, Bodmin and Fowey.
12. Truro and St. Ann.
13. Algavoar Moor.

And other lines in Flintshire.

He likewise projected and surveyed several harbours, turnpike roads and canals in various parts of the kingdom. Amongst others we may mention the Sheerness, Perrosport

and Devoran harbours, and a ship canal from the Tamar to the north coast of Cornwall. His judgment upon the value of landed property was most correct, and was founded upon sound practical and theoretical geological knowledge, as well as upon local circumstances. His reports upon the many extensive estates with which he was connected, agricultural as well as mineral, would, if collected, form a work of great value and utility. As a mineral surveyor his fame appears to have been more than European—as (why or wherefore we know not—but so is the fact) he received a present of iron ore from Napoleon Buonaparte from the island of Elba—fragments of which are still preserved by his family. His talents, of course, brought him unsought honours from various learned bodies—that of member of the Geological Society was most consistent with his pursuits and genius. Mr. James's capacities were of universal application. In addition to the performance of the unprecedented extent of business we have before detailed, he at the same time engaged deeply in agricultural pursuits—as a farmer and breeder of cattle and sheep. He was engaged largely in the growth and manufacture of flax. A salt work at Droitwich, he purchased, and afterwards sold with a plan of his invention of making salt by steam, to his friend W. Furnival, Esq. Drainage and inclosure, and other bills, were repeatedly submitted to him for revisal, previous to their enactment by the legislature.

In disposition Mr. James was open and generous, in temperament sanguine and energetic. His powers of mind were of a remarkable character; though versatile, they were strong; he did not throw off one undertaking to devote himself to another; but the working out of the new idea was an occupation added to that already on the tapis; hence the accumulation of engagements that so rapidly grew upon him, and rendered necessary the keeping of various establishments in different parts of the country, to each of which he would pay a passing visit, post haste, and be it day or night, transact business, take a short repose, and proceed to another. His conversational talents, and fund of ready wit and anecdote, were remarkable. In epistolary correspondence he excelled; and amidst the interruptions of conversation or business he would with great rapidity write letters in a style of great perspicuity and elegance. Though corpulent, his manners were elegant and easy, and by the *suaviter in modo* he was nearly always successful in accomplishing his wishes, especially with his noble and aristocratic employers, patrons and friends.

The portrait which embellishes our present volume is engraved from a miniature by Chalon, painted when Mr. James was about forty years of age, and the engraving is deemed by his family and friends to bear a very strong resemblance to its original.

LIST OF ENGLISH PATENTS GRANTED IN SEPTEMBER, 1839.

Charles Greenway, of Douglas, in the Isle of Man, for certain improvements in snuffers. Patent dated Sept. 5; six months to specify.

Bryan Donkin, of Blue Anchor-road, Bermondsey, engineer, for an improvement or improvements to be used in the process of making paper by hand or by machinery. (A communication.) Sept. 5; two months.

Paul Robin, of Saint Paul's-chain, London, gent., for improvements in spinning. (A communication.) Sept. 9; six months.

John Rapson, of Emmett-street, Poplar, millwright and engineer, for improvements in steering ships and vessels. Sept. 9; six months.

Frederick Brown, of Luton, Bedford, ironmonger, for improvements in stoves or fire-places. Sept. 9; six months.

Samuel Stocker, of High Holborn, pump-maker, for improvements in beer, cyder, and spirit engines. Sept. 11; six months.

Moses Poole, of Lincoln's Inn, gent., for improvements in apparatus applicable to steam-boilers, in order to render them more safe. (A communication.) Sept. 11; six months.

Stephen Rogers, of Bristol, merchant, for certain improvements in building the walls of houses and other edifices. Sept. 16; six months.

Isaac Dodds, of Masbro, and William Owen, of Rotherham, York, civil engineers, for certain improvements applicable to railways, and in the construction and manufacture of wheels, engines, and machinery to be used thereon, part or parts of which are applicable to other engines, and which wheels, without a flange, are also applicable for use on turnpike roads. Sept. 16; six months.

Job Taylor, of Pendleton, near Manchester, joiner and builder, for certain improvements in machinery or apparatus for cutting or forming ornamental mouldings or devices in wood and other materials. Sept. 19; six months.

William Newton, of Chancery-lane, for an improved machine or apparatus for weighing various kinds of articles or goods. (A communication.) Sept. 19; six months.

John Wertheimer, of West-street, Finsbury-circus, printer, for improvements in producing ornamental raised surfaces on paper. (A communication.) Sept. 19; six months.

Thomas Todd, of Kingston-upon-Hull, gent., for improvements in propelling vessels. Sept. 19; six months.

Henry Needham Scrope Shrapnell, of Gosport, gent., for improvements in corkscrews. Sept. 26; six months.

Samuel Wilkes, of Catherine Cross, Darleston, Staffordshire, iron-founder, for improvements in boxes and pins or screws for vices and presses. Sept. 26; six months.

William Henry Hornby and William Kenworthy, both of Blackburn, manufacturers, for certain improvements in the machinery or apparatus for sizeing and otherwise preparing cotton, wool, flax and other warps for weaving. Sept. 26; six months.

Joseph Clinton Robertson, of the Patent Agent Office, 166, Fleet-street, London, patent agent, for an improved method of manufacturing artificial marble. (A communication). Sept. 27; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN 22ND OF AUGUST, AND 22ND SEPTEMBER, 1839.

James Capple Miller, of Manchester, Lancaster, gentleman, for certain improvements in printing calicoes, muslins, and other fabrics. Sealed 26th of August, 1839.

Barclay Farquharson Watson, of Lincoln's Inn Fields, Middlesex, solicitor, (communication from a foreigner residing abroad,) improvements in crushing or preparing New Zealand Flax (Phormium Tenax). September 4.

Mathew Uzielli, of King William-street, London, merchant, (communication from a certain foreigner residing abroad) improvements in impregnating wood or timber with chemical materials. Sept. 4.

John Augustus Tulk, of Seaton and Louca Iron Works, Cumberland, iron master, for improvements in the manufacture of iron. September 4.

Frederick Parker, of New Gravel-lane, Shadwell, Middlesex, animal charcoal manufacturer, for improvements in revivifying, or restoring animal charcoal. September 6.

John Dickson, of Brook-street, Holborn, London, engineer, for improvements in rotatory steam engines. September 6.

William Hale, of Greenwich, Kent, engineer, for an improvement in steam engines, and apparatus connected therewith, and in machinery for propelling vessels, part of which improvements are applicable to raising or forcing fluids. September 7.

Robert Carey, of Breadgar, near Sittingbourne, Kent, (communication from a certain foreigner residing abroad) for certain improvements in paving, or covering streets, roads, and other ways. September 17.

LIST OF IRISH PATENTS GRANTED IN AUGUST, 1839.

James Walton, for improvements in machinery for making wire cards.

Wilton Wood, for an improved method of making bands and tackling to be used in driving, turning, and carrying machinery.

James Taaffe for improvements in roofing and slating houses.

James Whitelaw, for an improved rotatory machine to be worked by the reaction and pressure of a column of water, which machine may be used as a steam-engine; an improved water meter; and a machine for raising water or other fluid by its centrifugal force.

H. G. Dyar and J. Hemming, for improvements in the manufacture of carbonate of soda.

Matthew Heath, for improvements in clarifying and filtering water, beer, wine, and other fluids.

Peter Lomax, for improvements in looms for weaving.

Moses Poole, for improvements in tanning.

G. H. Palmer, for improvements in paddle-wheels for propelling ships, boats, &c.

J. Cutler, for improvements in combinations of metals applicable to the making of tubes or pipes, or other purposes, and in the method of making tubes or pipes therefrom, which improvements are applicable to the making of tubes or pipes from certain other metals and combinations of metals.

J. Mercer, J. D. Prince, and J. Blythe, for an improved process of printing, dyeing, or colouring cotton, woollen, silk, or other cloth or yarn.

NOTES AND NOTICES.

Annual August Shower of falling Stars.—(From the *Prussian State Gazette*.)—Statement of the great fall of stars in the night of the 10th of August, 1839:—"The sky has been again particularly propitious for observing another fall of stars. On many days and nights preceding the 10th the heavens had been so covered that we could not observe when the uncommonly frequent fall of stars commenced. On August 10, however, our hopes of seeing the phenomena increased owing to the clearness of the weather, and we were perfectly satisfied towards night-time. Already, as early as dusk, an extraordinary fall of stars began. It was not, however, sufficient to count the numbers that fell; it was desirable also to measure the time of their appearance, and of the continuance of their fall, according to Franzmann's instrument, which beats thirds of seconds, and, moreover to ascertain their relative light and apparent course in the heavens and all these observations could commence only at 26 minutes past 9, when all the observers, 15 in number, were assembled, occupying six windows of the observatory. Four gentlemen took care to observe and register the time of each appearance, according to two clocks. Till 14 minutes past 3, when dawn put a stop to the observations, they noticed 1,008 falling stars, not including numbers which must have been overlooked, because the number of observers was insufficient. Sometimes the stars succeeded so rapidly, that nothing but the time could be noted down. The courses of only 977 have therefore been marked upon the star-maps, with all the circumstances relative to them. The following result is as near the exact truth as possible:—Five stars appeared as bright as Venus, 14 as Jupiter, 238 as stars of the first magnitude; 345 were noted of the second, and 257 of the third magnitude; 101 were reckoned smaller still, and the size of eight was omitted in the hurry; 273 exhibited themselves with tails. It is useless to mention the apparent paths of the stars, inasmuch as they varied according to the places of observations; but we may just infer from that circumstance the possibility of measuring their distance and height from the earth. We therefore should wish for corresponding observations in foreign countries. Three of our zealous observers devoted the following night also to science, and saw 323 falling stars, whilst the sky was partly covered. In the night of August 12, an observer counted 103 more, from 10 o'clock to 45 minutes past 1. Therefore the annual periodical return of an uncommon fall of stars towards the 10th of August is once more confirmed, as well as that the passage of this host of meteors near the earth last several days. If it were possible, with the aid of corresponding observations, to calculate the direction of their passage with reference to the movement of the earth and their rapidity, we should then be able to form a notion of the extent which these multitudes of stars occupy in space.

"Von Boguslowski.

"Breslaw, August 14, 1839."

Seine Steam Navigation Difficulties.—The Seine steamers are very long (about 150 feet) and narrow, drawing only about two feet water, and yet in summer they often take the ground. In winter they cannot run, as the height of the water leaves no space to pass through the bridges. Iron boats have been recently introduced, and with good effect.

Hardening Iron.—Sir,—Observing in your 836th number a description by Mr. Baddeley of the "new" process of casehardening by prussiate of potash, I beg to refer him to page 64 of the xxv vol. of your Magazine (published about 3½ years ago), where the "pith and marrow" of the matter is given in a few words. No doubt, however, Mr. B.'s extended notice may be useful. I remain, Sir, &c., IOTA.

New Mode of Resuscitation from Drowning.—At the annual meeting of the Bristol Humane Society, on Tuesday, the Society's silver medal was presented to Dr. Fairbrother, of Clifton, for his exertions in recovering a boy who had been under the water in the floating harbour about half an hour, and another quarter of an hour had elapsed before the doctor could operate on the body. The most remarkable feature in this case is the new mode by which Dr. Fairbrother succeeded in his laudable object: namely, by closing the boy's mouth with his finger, sucking off the foul air from his lungs

through the nostrils, and promoting respiration by pressing on the abdominal muscles on the side. The usual method is to inflate the lungs, but it is very seldom that persons are recovered by this method if they have been longer than a few minutes under the water.

A New Railroad.—We are assured by the *Siecle*, a French paper that a new railroad, *without the use of steam*, and *suspended in the air*, is at present in agitation at Paris; and that M. Touboulac, the nventor of this new locomotive machine, which he calls "Veloposte," has had an audience of His Majesty. It was expected that a public experiment would shortly take place.

Antarctic Expedition; a "Mistake."—A correspondent of the *Times*, (Sept. 26th), who signs himself "Cui Bono," notices a most extraordinary mistake on the part of the Royal Society, and managers of this expedition. He says:—"The voluminous paper of instructions prepared for Capt. J. C. Ross by the President and Council of the Royal Society, contains a very ample statement of the principles on which his magnetic apparatus has been constructed, the purposes to which it is to be applied, and the grand results expected to be attained through their employment. No less than 29 pages of the *Philosophical Magazine* for the present month are taken up with a quotation from the "instructions" on this single subject, out of 66 pages devoted to the entire expedition and its innumerable *desiderata*: yet, in that extent of paper, not a word is said of what all practical men must feel to be of primary importance—the *mode* of *making* the artificial magnets themselves—the *manner* of imparting to the passive steel that active principle on whose proper lodgement (if I may be allowed the expression) the correctness of all subsequent operations, observations, and calculations must depend. This grave omission excited my curiosity, and I made particular inquiries respecting their preparation. I have learned with sorrow that an artist of this city "magnetized" the steel bars sent him by Dr. Lloyd, of Dublin, (to whom, I understand, all the magnetic arrangements were committed) by the aid of a voltaic magnet! The result is, that the bars are good for nothing for the purposes of the expedition! A "magnet," (if it can correctly be called one) made in such a manner is but a philosophical toy, possessed of properties that render it useless for all practical observations connected with terrestrial magnetism. This is deeply to be regretted, as all the patient research and ingenuity displayed by Dr. Lloyd in the construction of complicated and delicate apparatus, and all the industry and accuracy of Captain J. C. Ross and his brother voyagers in observing with them, will be thrown away! I know not who is to blame in the matter, and shall therefore confine myself to an exposition of the nature of the evil committed; leaving it to those immediately concerned to take the speediest steps to remedy it. Not to lose time in discussing the minor faults of a bar or needle "magnetized by a voltaic magnet," I come at once to its grand and insurmountable misfortune, viz., that instead of having (like a magnet of the old and approved make) a single steady north pole created at one end, and a single steady south pole at the other, it is found to possess from half a dozen to half a hundred north and south poles throughout its length. The number of these "consecutive poles" (as they are termed) will vary with the strength of the voltaic current employed, with the time consumed in the operation, and with the awkwardness of the operator. If he allow for an instant his steel bar or needle to "sit fast" or pause under the strong attraction of the voltaic magnet, there is a pole induced which no coaxing or manœuvring can subsequently get rid of; and so on. The existence of these opposing poles, scattered here and there, can be easily discovered by presenting a very small compass needle (magnetized in the ordinary mode) to a bar prepared by a voltaic magnet; and carrying it slowly alongside from end to end, when its sudden changes and repulsive whirls will clearly point out the numbers and positions of all the poles in the bar: the north pole of the little needle indicating the localities of the south poles in the bar, and the south poles similarly detecting its north ones, each pole of the little test needle making a point at its opposite in passing. It is obvious that "magnets" exhibiting such discrepancies cannot be depended on as true indicators of polarity."

Chemical Powers of Light.—M. Edmond Becquerel has recently communicated to the Academie des Sciences some important investigations on the chemical powers of solar light, which will probably lead to new and valuable results. It has been long known that light has the power of variously affecting certain chemical compounds; sometimes causing combination between two elements, and in other cases effecting the decomposition of compound substances; and it has been found that when a pencil of light is decomposed by passing through a prism of glass, those rays which possess this power are differently refracted from the coloured rays, and hence the existence of peculiar rays, to which the name of chemical rays is given, has been deduced. The chief difficulty in experiments on these rays has been, the slow nature of the actions caused, and the difficulty of appreciating them. M. Becquerel has overcome these sources of uncertainty, and is enabled to study the chemical power of light with ease, and measure the effects produced, with considerable accuracy. The manner in which this is done is very simple. Two liquids of different densities, but both conductors of electricity, and of such a nature as to act chemically upon each other when exposed to the influence of solar light, are selected; and a portion of both is put into a cylindrical vessel blackened on the exterior. A plate of platinum is placed in the denser of the two fluids, and another similar plate is also immersed in the lighter liquid; these plates being then connected by means of platinum wires with the two terminations of a very delicate galvanometer, the apparatus is complete. If when thus arranged a ray of light is suffered to pass through the mass of fluid, it causes chemical action to take place at the surface of contact between the two liquids, and a current of electricity which this sets in circulation is immediately rendered evident by the galvanometer. As the angle of deflection of the galvanometer indicates the power of the electric current, and as that is in exact proportion to the chemical action which originates it, it is evident that this arrangement gives an accurate measure of the power of the chemical rays of light, at different times, from different sources and under various circumstances. M. Becquerel details some experiments on the quantity of these chemical rays, which is intercepted when a ray of light is made to pass through screens of different substances, such as rock crystal, mica, and variously coloured glasses; and states that he is still engaged in experimenting on the subject.—*Athenæum.*

MECHANICS' MAGAZINE, VOL. XXXI, will be published on the 1st of October, price, in half-cloth, 8s. 6d., embellished with a portrait, engraved on steel, by W. Roffe, from a miniature by Chalon, of the late WILLIAM JAMES, ESQ., the Projector of the Railway System. Also, the SUPPLEMENT TO VOL. XXXI, containing Title, Index, Lists of Patents, and Portrait, Price 6d. COMPLETE SETS of the MECHANICS' MAGAZINE, thirty-one volumes, Price £13 1s.

END OF THE THIRTY-FIRST VOLUME.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 166, Fleet-street.*—Sold by A. & W. Galignani, Rue Vivienne, Paris.

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